July, 1958

The Mining Magazine

VOL. XCIX. No. 1. LONDON. PRICE: 3s.; With postage 3s. 8d.

W.C. 2

The Mining Magazine

PUBLISHED on the 15th of each month at SALISBURY HOUSE, LONDON, E.C. 2
for MINING PUBLICATIONS, LTD.

Editor : F. HIGHAM, A.R.S.M., M.Sc., M.I.M.M.

Manager : ST. J. R. C. SHEPHERD, A.R.S.M., D.I.C., F.G.S. *Chairman :* H. E. FERN, O.B.E., J.P.

Telephone : *NATional* 6290. Telegraphic Address : *Oligoclase.* Codes : *McNeill,* both Editions, *& Bentley.*

PRICE 3s. ; with postage 3s. 8d. Annual subscription, including postage, 35s. ; U.S.A., $6.00.

Vol. XCIX. LONDON, JULY, 1958. No. 1.

CONTENTS

EDITORIAL

TO provide scholarships tenable at mining schools and universities in the United Kingdom for courses in mining engineering and related subjects the B.O.M.A. Educational Trust has been established by the British Overseas Mining Association. It is hoped that up to ten scholarships, the value of which will vary up to a maximum of £400 per annum, not subject to means tests, will be made available each year. In addition it is proposed to offer one or possibly two awards of £500 per annum each year for a two years' conversion course in mining engineering or a related subject at the Royal School of Mines to men who have recently graduated in some other branch of engineering.

AMONG names that will have been noticed in the Queen's Birthday Honours List published last month were those of Sir Ellis Robins, President of the British South Africa Co., who receives a Barony and Mr. J. Cowan, the principal electrical inspector of mines in the Ministry of Power, who receives the C.B.E. The O.B.E. has been awarded to Mr. J. S. Dunbar, chief draughtsman, Geological Survey of Tanganyika, Mr. J. B. McCarthy, senior administrative officer Sierra Leone Selection Trust, Dr. S. H. Shaw, deputy director, Overseas Geological Surveys, Colonial Office, Mr. F. Shooter, district inspector of mines and quarries, East Midlands Division, Ministry of Power, and Mr. P. B. Smith, senior experimental officer, Safety in Mines Research Establishment. Mr. C. Boocock, director of the Geological Survey, Bechuanaland Protectorate, receives the M.B.E.

IT was announced in London earlier this month that the International Nickel Co. of Canada, Ltd., is to make a further curtailment in nickel production and this will reduce the company's output to a rate of approximately 200,000,000 lb. a year. The announcement in Copper Cliff said : " Since our last curtailment of production, stocks of unsold nickel in our hands and in the hands of the United States Government have continued to accumulate and now total about 135,000,000 lb., exclusive of nickel in the United States Government stockpile and of unconsumed nickel in the inventories of customers. . . . The company has a nickel production capacity at Sudbury of over 300,000,000 lb. per year and full production can at any time be resumed with a minimum of delay." The curtailment of production is not to affect the new nickel project at Thompson in Manitoba, which is scheduled for completion in 1960 and will have a capacity of 75,000,000 lb. per year.

SPEAKING recently in South Africa the Union Minister of Mines, Dr. A. J. R. Philip, referred to the agreement regarding the sales of uranium oxide to the Combined Development Agency which had been concluded following discussions in Pretoria between British and United States representatives of the Agency and the South African Atomic Energy Board. As from July 1 a maximum limit of 6,200 tons a year has been placed on South Africa's sale to the Agency, any excess now being allowed to be sold elsewhere. This figure of 6,200 tons can be compared with last year's total production of 5,709 tons, which is believed to be higher than that of any other country. The average grade of South African uranium-bearing ore (between ½ lb. and 1 lb. of oxide per ton of ore) is lower than that of countries such as the United States and Canada. On the other hand the regularity of the Union's ore-bodies, together with an enormous potential, it is thought, gives the Union industry considerable stability and long-term advantages.

THE annual report of the Inspector of Mines for Cyprus covering 1957 shows that although the quantity of mineral products exported during the year was slightly higher than in 1956 the lower prices received for copper and sulphur products reduced the total value of mineral exports from £13,845,254 to £10,440,691. Direct revenue from mining operations amounted to £67,933, as compared with £59,729 in 1956. Since the price of copper, as the report says, continued on the decline throughout the year and the outlook for 1958 is less bright than in recent years a further drop of approximately £2,000,000 in the value of mineral exports can be expected. During the year under review 139,192 tons of cupreous concentrates, valued at £3,889,572, and 762,501 tons of iron pyrites, valued at £3,379,550, accounted for approximately 70% of the total

value of mineral products exported. The other principal products contributing to the total value were 226,334 tons of cupreous pyrites, valued at £1,824,987, 3,900 tons of cement copper, valued at £467,586, and 11,886 tons of asbestos, valued at £717,711.

DURING the first half of April the Commission for the Geological Map of the World met in Paris, 60 countries being represented on the occasion. The Commission, a permanent body set up by the International Geological Congress, now in its 80th year, was founded at the Stockholm Congress in 1910 and it has been re-organized twice since the Second World War, first in 1948 in London and again in Algiers in 1952. One of the tasks at the Paris meeting was to organize two new Sub-Commissions created in principle at the Congress of Mexico in 1956. These are a Sub-Commission for the Tectonic Map of the World and one for a Metallogenic Map. Professor N. Schatsky of Moscow is to act as president of the Sub-Commission for the Tectonic Map, while Dr. W. D. Johnston, Jr., of Washington, has been elected president of the Sub-Commission for the Metallogenic Map. The president of the Commission for the Geological Map of the World, since 1952, is M. Fernand Blondel, of Paris. The secretariat is in Paris at the Bureau d'Etudes Géologiques et Minières, the same organization having acted for the Association of African Geological Surveys since 1936.

Swedish Iron Ore

Writing in the Skandinaviska Banken's latest *Quarterly Review* Mr. Jonas Nordensen, managing director of Malmexport AB., the joint sales company of the Grängesberg and LKAB mining companies, emphasizes that in spite of the fact that Sweden's share of the world's total output of iron ore does not amount to more than some 5% much importance attaches to Swedish ore on the international market. Indeed, as a very large proportion of iron-ore mining both in Western Europe and the United States is integrated with iron and steel production Sweden's share in the total marketed quantity of iron ore becomes vital in view of its quality. In fact, although Sweden cannot be said to hold a position enabling her to dictate prices on the ore market, the agreements concluded with the big buyers on the European Continent and in Britain have for a long time past greatly influenced subsequent contracts. In the first place Malmexport AB is still the biggest seller of ore in the world and, in the second place, the Swedish contracts have as a rule ushered in the period of negotiations. Almost without exception the Swedes sell the ore in large consignments for delivery in the immediately succeeding year. For instance, the Swedes meet in Germany a joint delegation from all the Ruhr works, in England the wholly-owned subsidiary of the British Iron and Steel Corporation, Ltd., which purchases all imported ore on behalf of the British works, and in Belgium representatives of the Groupement des Hauts-Fourneaux et Aciéries Belges.

The trend of iron-ore prices has been far steadier than that of many other raw materials and semi-manufactures, Mr. Nordenson says. The risk of sudden future fluctuations in prices, which any branch of industry runs when the share of the variable costs is relatively small, is largely eliminated thanks to the long-term engagements. It is not in the interest of the combined ore-producer ore-consumer to contribute to an unsteady development of prices. Experience has shown that not only the producers of ore who are integrated with the iron and steel industry but also the large-scale independent producers have been able to assist in the adjustment of the supply to the current demand, thereby avoiding situations of excess surplus or excess deficit and steep falls or rises in prices. The prospects, therefore, of the future trend of ore prices being reasonably stable would seem to be fairly bright, it is considered.

Rand Gold, Vulnerable Mines, and the Gold Price

In his address to the Transvaal and Orange Free State Chamber of Mines, delivered at the annual meeting held in Johannesburg on June 30, the president, Mr. H. C. Koch, said that the 1957 figures of production included several new records for the industry. Although the tonnage of ore milled, at 66,114,000, was 1,410,000 tons less than in 1956, the gold output reached the record figure of 16,575,000 oz. fine, well over 1,000,000 oz. more than the previous year's output. The total working revenue from gold was, of course, also a record ; at £207,706,000

it exceeded £200,000,000 for the first time. On the Witwatersrand, from Nigel to Randfontein, the value of gold produced in 1957 was £99,000,000, against £106,000,000 the year before, while the Far West Witwatersrand and Klerksdorp areas together accounted for gold production worth £61,000,000, as compared with £47,000,000 in 1956 and the value of the Orange Free State's production rose to £47,000,000 from £40,000,000. Other mines in these newer areas and in the new Kinross field are, the president said, in the course of development. Production in the newer areas is, he thought, likely to continue for some years to increase at a rate exceeding that of the decline in the older mines and the achievement of the industry last year is not likely to be its ultimate peak.

In spite of its present prosperity the gold-mining industry still labours under certain important disabilities, Mr. Koch pointed out. Working costs are still rising while the price of gold remains unchanged, there are still certain labour deficiencies, a number of mines face a serious decline in production and profits, and there are aspects of gold-mining taxation which are still a discouragement to risk capital. The declining mines referred to include mines often described as " vulnerable "—namely, those which by reason of a combination of ore exhaustion and narrow profitability are coming precariously near the point of closure. This problem chiefly affects the Witwatersrand at the present time, where there are probably no more than half-a-dozen mines that may fairly be said to be in the vulnerable category at present although there are more than twice as many operating on margins of profit not substantially different from the annual increase in the industry's average working cost per ton.

Vulnerable mines were, as Mr. Koch pointed out, the subject of a round-table conference convened by the Minister of Mines. It took place during the latter part of 1957 between representatives of the Department of Mines, the Mine Officials' Associations, the Mining Unions' Joint Committee, and the Chamber. Its object was to discuss measures to prolong the lives of vulnerable mines and to stagger their closure so as to mitigate the effects of such closure on neighbouring communities. At the outset the scope of the conference was defined within limits that excluded the discussion of any matter affecting wages or the existing framework of the mining regulations, including the division of work between Europeans and non-Europeans. Within the restricted scope that remained, however, the conference was able to agree on a number of suggestions whereby small reductions in mine working costs might be brought about and its report has been forwarded to the Minister. These suggestions covered chiefly the relief of vulnerable mines from charges imposed by certain authorities, but did not include any form of State subsidy or any form of assistance of one mine by another. Meanwhile where employees have been affected by the curtailment of operations the companies concerned have helped them to obtain new employment and generally the co-operation between the employers and the employees on these occasions has been noteworthy. In spite of this worry, however, the president reminded the meeting that " gloomy prognostications about gold mining in South Africa take no account of its remarkable displays of resilience throughout its 70-odd years of life. The industry has continually expanded and to-day it is calculated that the quantity of gold that can be recovered economically from proved mining areas is greater than at any time in its history. The sustained expansion of gold mining over a long period has been made possible by the discovery of new gold-bearing areas, by the development of prospecting and mining techniques, including those of deep-level mining, by increases in the price of gold, and by the willingness of investors to put up many millions of pounds of risk capital over many years."

The president pointed out that a subject of prime importance is the price of gold, but for a long time it has not received much study outside gold-mining circles. Recently it had, however, engaged widespread attention for reasons mainly connected with the present economic conditions of the world and of the United States of America in particular. He himself was sure that the upward revaluation of world stocks of monetary gold " would restore international liquidity to a degree that would ensure that countries in difficulties with their trade balances had the necessary breathing space to make appropriate adjustments to their basic economies without resorting to measures damaging to their neighbours." While the key to the situation lies in America the president thought the case for an early and substantial revaluation of gold in terms of all currencies rested on nothing so much as on plain common sense and most mining men will agree with him.

MONTHLY REVIEW

Introduction.—With signs of returning confidence in the United States the business climate has become more settled and commodity prices remain steady at present lower levels. Steel output in the United Kingdom is down as compared with 1957, but it is hoped that relaxation of the credit squeeze may stimulate orders.

Transvaal.—The gold return figures for the Rand and O.F.S. mines for May show a production of 1,435,960 oz., making with 36,494 oz. from outside mines a total of 1,472,454 oz. for the month. The number of natives at work in the gold mines at the end of May was 337,464 as compared with 337,284 at April 30 last.

The table below shows dividends declared by the Rand mining companies for the past half-year. Figures for the three preceding half-years are added for comparison, the denomination of shares being £1 unless otherwise stated.

	2nd half, 1956	1st half, 1957	2nd half, 1957	1st half, 1958
	s. d.	s. d.	s. d.	s. d.
Blyvooruitzicht (2s. 6d.) ...	1 0	1 0	1 0	1 0
Brakpan (5s.) ...	0 6	0 4½	0 4½	0 4½
Buffelsfontein (10s.) ...	—	—	1 6	1 6
City Deep ...	0 6	0 6	0 6	0 6
Consolidated Main Reef ...	1 6	1 3	1 3	1 3
Consolidated Murchison (5s.)	7 6	3 0	1 9	2 0
Crown Mines (10s.) ...	2 0	1 0	1 3	1 6
Daggafontein (5s.) ...	2 9	2 6	2 9	2 6
Dominion Reefs (5s.) ...	1 3	1 3	1 6	1 6
Doornfontein (10s.) ...	—	0 6	1 0	1 0
Durban R'd'poort D'p (10s.)	1 6	1 6	1 6	1 6
East Champ d'Or (2s. 6d.) ...	0 7	0 3	0 4	0 3
East Daggafontein (10s.) ...	0 9	0 9	0 9	0 7½
East Geduld (4s.) ...	2 3	2 0	2 0	1 9
East Rand Prop. (10s.) ...	2 6	2 3	2 3	2 0
Eastern Rand Ext. (5s.) ...	0 6	—	1 3	0 9
Eastern Transvaal (5s.) ...	—	0 4½	—	—
Geduld Prop. ...	7 6	6 3	6 6	5 0
Government Areas (5s.) ...	0 3	—	—	—
Grootvlei Prop. (5s.) ...	1 4	1 1	1 3	1 1
Hartebeestfontein (10s.) ...	1 6	2 6	3 0	3 6
Libanon (10s.) ...	0 3½	0 3½	0 3½	0 3½
Luipaards Vlei (2s.) ...	0 10½	1 0	1 1	1 1
Marievale Consolidated (10s.)	1 3	1 0	1 3	1 1
Modderfontein East ...	2 0	1 0	0 9	0 9
New Pioneer Central Rand (5s.)	—	1 0	—	2 6
Rand Leases (10s.) ...	0 1½	0 1½	0 3	0 1½
Randfontein ...	2 6	2 3	2 3	2 0
Rietfontein Cons. (5s.) ...	1 1	1 1	1 1	—
Robinson Deep, B (7s. 6d.) ..	0 6	0 6	0 9	—
Simmer and Jack (2s. 6d.) ..	0 5	0 5	0 5	—
South African Land (3s. 6d.)	1 6	1 6	1 6	1 6
South Roodepoort M.R. (10s.)	1 1½	1 1½	1 1½	1 1½
Southern Van Ryn ...	0 2	—	0 5	—
Springs Mines (5s.) ...	0 3	—	0 4½	—
Stilfontein (5s.) ...	0 6	1 0	1 10½	1 10½
Sub Nigel (10s.) ...	2 4½	1 9	1 6	1 6
Transvaal G.M.E. (1s. 3d.) ..	0 10	—	—	—
Vaal Reefs (5s.) ...	1 0	1 3	2 3	1 6
Venterspost (10s.) ...	0 10½	0 10½	0 10½	0 10½
Village Main Reef (1s. 3d.) .	0 1	0 1	0 1	0 0½
Vlakfontein (10s.) ...	0 10	0 10	0 11	0 11
Vogelstruisbult (10s.) ...	1 6	1 4	1 2	1 0
West Driefontein (10s.) ...	3 0	3 3	3 6	3 9
West Rand, Ord. (10s.) ...	2 3	2 0	2 3	2 0
Western Reefs (5s.) ...	1 3	1 3	1 3	1 3
Witwatersrand Nigel ...	—	—	—	0 1½

A reference to remarks made by Mr. P. H. Anderson at the annual meeting of EAST RAND PROPRIETARY MINES held at the end of May is made elsewhere in this issue by our Johannesburg correspondent. Since the decision had been taken to sink a deep-level vertical shaft system in the far eastern section of the mine the result was that in effect an ultra-deep mine was being opened up and the capital costs of opening up an ultra-deep mine are substantial. In the circumstances and particularly with the prospect of increasing working costs and the large capital expenditure programme still lying ahead Mr. Anderson said it was being unrealistic to expect increased dividends unless there were a material increase in the price of gold.

In the three months to June 30 the reduction works at WINKELHAAK MINES was completed and trial milling is now in progress. In the quarter 5,240 ft. of development on reef was sampled, 3,825 ft. proving payable and averaging 7·9 dwt. in value over 39 in.

At extraordinary meetings of ROBINSON DEEP, RIETFONTEIN CONSOLIDATED, and SIMMER AND JACK MINES held in Johannesburg on July 11 reductions of capital were approved. Robinson Deep is to repay 1s. 6d. a share, Rietfontein 1s., and Simmer and Jack 6d.

Orange Free State.—Last month shareholders of LORAINE GOLD MINES and RIEBEECK GOLD MINING were informed that the directors of the two companies had recently held discussions with a view to arranging a merger of the two concerns and their mining areas. The Loraine company has spent considerable sums of money in endeavouring to bring the mine to a profitable basis, it was stated, although "there is little prospect of this being achieved in the immediate future." Loraine has considerable assets, however, which would, it is thought, be of advantage to the two mining areas if they were merged into one unit. The Riebeeck company is still some time away from the production stage and considerable capital expenditure could be saved, it is suggested, by making use of the assets of the Loraine company that the proposed merger would make available to the combined mining unit. These assets include comprehensive underground and surface mining equipment, a reduction plant, mine offices and workshops, and housing accommodation for both

European and Non-European employees. The plan is referred to elsewhere in this issue by our Johannesburg correspondent.

Diamonds.—Earlier this month DE BEERS CONSOLIDATED MINES announced that sales of diamonds effected through the Central Selling Organization in the June quarter totalled £13,934,105, of which £10,734,932 represents gem stones. At the De Beers annual meeting last month the chairman, Mr. H. F. Oppenheimer, referred to the prospecting operations on Annex Kleinzee. The consulting geologists, he said, have now reported that while it is not yet possible to give definite figures for the total diamond content or grade of the workable gravels within the 20,000-claim lease area sufficient work has been done to assume that there are at least 500,000 carats within the area at a grade which will allow of the property being worked at a reasonable profit. The company is, therefore, to proceed with mining operations there.

Southern Rhodesia.—The report of the MOTAPA GOLD MINING COMPANY for 1957 shows a profit of £8,463 and a credit balance of £9,758 carried forward. In the year 189,240 tons of ore was milled and 25,563 oz. of gold recovered. Ore reserves at December 31 last were estimated to be 174,000 tons averaging 3·3 dwt. in value. The report of the company's technical advisers states that results obtained from development were so disappointing that the scale of operations had to be reduced in the year. It is considered that prospects of bringing in new ore reserves are now limited to the main breccia body being payable when intersected on 12 level, where the widths of the ore-body " are such that they could give appreciable tonnages." There is also the extension below the 8 level shoot, east of No. 1 shaft, " which is, however, only 6·6 ft. wide on 8 level, and large tonnages are not expected," and the lateral extension of the Britwell ore-body westward on 3 level. Indeed, the position is considered so serious that it is unlikely that the life of the mine can be extended much beyond the period necessary to work out existing ore reserves. " Thereafter operations will be confined to reclamation of any dumps that can be treated economically and to clean up."

Northern Rhodesia.—The accounts of the NORTHERN RHODESIA COMPANY for the year ended May 30 last show a profit of £14,275 and £23,871 available, of which a dividend and bonus totalling 12½% require £7,187. After setting aside £6,756 for taxation and placing £5,000 to reserve there is a balance of £4,928 to be carried forward.

It was announced at the end of June by PRODUCTION ENGINEERING (CENTRAL AFRICA) (PVT.), LTD., that its independent survey of jobs performed by members of the Northern Rhodesia Mine Workers' Union had come to an end and a report has been submitted to both the Union and the Northern Rhodesia copper-mining companies. The survey, which began in May, 1956, was put in hand in compliance with a clause in the agreement on African advancement signed by the Union and the companies in September, 1955. The survey's success, it was stated, was made possible by the co-operation of the Union and management and their intention to honour the terms of the agreement.

Ghana.—The accounts of the WESTERN SELECTION AND DEVELOPMENT COMPANY for the year to September 30 last show a profit of £60,171 and £164,774 available. A credit balance of £77,401 is carried forward.

Nigeria.—GOLD AND BASE METAL MINES OF NIGERIA, LTD., reports a profit of £10,989 for 1957, the accounts showing a credit of £26,537 carried forward. In the year 1,049 tons of tin concentrates and 134·2 tons of columbite were produced. The proved reserves of ore at the end of the year are given as 5,226 tons of cassiterite and 354 tons of columbite. It is stated that in the year application was made to Government for a special exclusive prospecting licence covering approximately 100 sq. miles adjoining the company's holdings at Jema'a. Geological reconnaissance and prospecting are to be carried out during 1958 and will include the use of aerial photography and suitable mineral detecting instruments. At the same time exploration of the Jema'a Tsoni pegmatites was continued, underground driving being necessary to follow the flat sills carrying the ore-shoots. Payable values have been intersected at various points, but much further work is necessary before making an assessment.

The report of EX-LANDS NIGERIA, LTD., for 1957 shows a profit of £81,352. With the sum brought in there was £128,746 available of which £54,037 is required for a dividend equal to 15% and £30,000 for taxation. In the year 695 tons of cassiterite was produced, the reserves at December 31 last being given as 4,098 tons contained in 10,124,640 cu. yd. of ground.

The operations of the BISICHI TIN CO. (NIGERIA), LTD., in 1957 resulted in a profit of £59,339. Of the total sum available £50,000 has been placed to reserve, while £27,960 is required for a dividend equal to 10%, leaving £131,649 unappropriated. In the year the company produced 792 tons of tin concentrates and 207 tons of columbite, the reserves at December 31 last being calculated as 2,275 tons of tin ore and 1,834 tons of columbite.

NARAGUTA EXTENDED AREAS reports a profit of £9,146 for 1957, the accounts showing £10,866 for appropriation, of which a dividend equal to 5% requires £2,980. The output for the year was 227 tons of tin ore.

Malaya.—Last month shareholders of TRONOH MINES were informed that an offer made to PUKET TIN DREDGING for the purchase of their mining leases, buildings, dredge, and spares and stores, together with the assessment under the Tin Control Regulations, for a cash price of £107,000, had been accepted subject to confirmation by shareholders. The purchase was to take effect as from July 1.

India.—The report of the CENTRAL PROVINCES MANGANESE ORE CO., LTD., for 1957 shows a profit of £1,007,340. With the sum brought in there was £1,288,537 available, of which dividends equal to 4s. 2d. free of tax require £625,000. Speaking at the annual meeting last month the chairman, Mr. A. C. Herring, said that the diamond-drilling programme had been continued and drilling had taken place at Kandri, Ukwa, and Sitasaongi mines, indicating considerable tonnages of good-quality ore at Kandri and Ukwa. The Balaghat mine had recently been connected to the Government electricity grid supply and Tirodi should soon be connected. Most construction work at these two mines had been completed. Shaft sinking was suspended at Balaghat mine while the permanent headgear was erected and the two electric hoists were now available for work in Holmes shaft, where sinking has been resumed.

Burma.—In the three months to March 31 last the BURMA CORPORATION (1951), LTD., milled 30,623 tons of ore and produced 3,214 tons of refined lead, 138 tons of antimonial lead, and 303,267 oz. of silver. In addition 62 tons of copper matte, 118 tons of nickel speiss, and 4,552 tons of zinc concentrates were reported. The operating profit of the company for the nine months to March 31 is given as K12,85,000 (£96,375).

British Guiana.—At the annual meeting of BRITISH GUIANA CONSOLIDATED GOLDFIELDS last month shareholders were reminded that at last the company had two dredges in operation, both using hydro-electric power generated by the subsidiary, the POTARO HYDRO-ELECTRIC CO., LTD., which started operations in June, 1957.

Brazil.—In his review accompanying the report and accounts for 1957 the chairman of ST. JOHN D'EL REY MINING, Mr. Leo Model, says that plans are in hand for the exploration of the company's large iron-ore deposits with a view to creating an important iron-ore export operation. The HANNA COAL AND ORE CORPORATION has sent teams of engineers and geologists to Brazil to carry out an intensive investigation of the company's gold mines and undertake detailed exploration of the iron-ore reserves; this investigation will take at least one year before further definite decisions can be taken. An endeavour is to be made to find new ore in the Morro Velho gold mine between No. 8 level (2,264 ft.) and surface and it is thought likely that decisions upon the rehabilitation of the plant will have to be deferred until the results are known. During 1957 a Fluosolids reactor was installed at the company's arsenic-producing plant at Galo adjacent to Morro Velho and it is expected that this plant will increase efficiency in the recovery of gold and arsenic from current concentrates and from old stockpiles.

Colombia. — PATO CONSOLIDATED GOLD DREDGING reports a profit of $500,000 for the three months to March 31 last, subject to audit. In the period 6,479,000 cu. yd. of ground was treated and 36,750 oz. of gold recovered.

Canada.—It was reported earlier this month that two groups of placer gold claims in Nova Scotia had been acquired by NEW BRUNSWICK URANIUM METALS AND MINING, LTD., from RIO TINTO CANADIAN EXPLORATION, LTD., for staking costs. One group, of 266 claims, is situated in the Guay's River area, some 25 miles south of Truro, Nova Scotia, while the second, of 354 claims, is in the St. Ann's Mountain area, near the east coast of Cape Breton Island. Both areas are considered favourable for placer gold deposits and a preliminary programme of surface panning and stream silt sampling is to be undertaken later this season. New Brunswick Uranium is also participating with Rio Tinto in a prospecting programme now underway

some 60 miles north-east of Havre St. Pierre, on the north shore of the St. Lawrence River.

Portugal.—The operations of MASON AND BARRY, LTD., for 1957 resulted in a loss of £47,659, which reduces the credit balance brought in to £11,623. In the year the company mined 142,476 tons of pyrite.

Cyprus.—In a progress report issued last month the ESPERANZA COPPER AND SULPHUR COMPANY reports that leaching of the Limni semi-oxidized ore has begun and that copper is being produced, while sales of cupreous pyrites continue on a good scale. Production of copper-gold-silver concentrate has also begun. The company continues its geophysical prospecting campaign in search of further ore-bodies.

British Tin Investment Corporation.—The accounts of the British Tin Investment Corporation for 1957 show a net revenue of £291,808 and a total of £427,529 available, of which dividends equal to 35% require £423,648, leaving £3,881 to be carried forward.

Central Mining and Investment Corporation.—The report of the Central Mining and Investment Corporation for the year ended March 31 last shows a group profit of £2,165,563 and £2,956,208 for appropriation. Of this amount £1,023,054 has been set aside for taxation and £1,000,000 placed to reserve, while £493,063 is required for dividends, equal to 4s. on the ordinary shares. After making other allowances a balance of £417,529 is carried forward.

DIVIDENDS DECLARED

* Interim. † Final.

(Less Tax unless otherwise stated.)

African and European Investment Co.—Pref. 3%, payable Aug. 15.

***Amalgamated Collieries of South Africa.**—1s. 6d., payable Aug. 15.

†Anglo-Transvaal Consolidated Investment.—Pref. 11¼%, Ord., 50%.

***Apex Mines.**—3s., payable Aug. 7.

***Apex (Trinidad) Oilfields.**—6d., free of tax, payable July 23.

†Aramayo Mines in Bolivia.—4%.

***Associated Manganese Mines of South Africa.**—4%.

†Bisichi Tin Co. (Nigeria).—3d., payable July 15.

†Central Mining and Investment Corporation.—2s. 6d., payable Aug. 9.

†Central South African Lands and Mines.—5%.

***Consolidated Diamond Mines of South-West Africa.**—Pref. 4½d., Ord., 5s., payable Aug. 15.

***Coronation Collieries.**—9d., payable Aug. 15.

***Coronation Syndicate.**—3d., payable Aug. 1.

***De Beers Consolidated Mines.**—10s., payable July 28.

†Derbyshire Stone.—17½%.

***English China Clay.**—2%, free of tax, payable July 16.

†Ex-Lands Nigeria.—15%, payable July 16.

Fresnillo Co.—Quarterly, 10 cents, payable July 10.

Idris Hydraulic Tin.—Special distribution, 6d., payable July 10.

†Indian Copper Corporation.—18%, free of tax, payable Oct. 6.

†Kinta Tin Mines.—1s., payable July 31.

***Malayan Tin Dredging.**—4d., payable Aug. 26.

†Mountain Copper.—6d., payable Aug. 9.

†Naraguta Extended Areas.—5%, payable Aug. 20.

†Natal Coal Exploration Co.—5d., payable Aug. 15.

†Northern Rhodesia Co.—7½% and 5% bonus.

***Rand Mines.**—2s. 9d., payable Aug. 7.

***Rooiberg Minerals Development Co.**—1s. 6d., payable Aug. 7.

†S.A. Minerals Corporation.—Pref. 3%, Ord. 1s. 3d., payable July 23.

†South African Coal Estates (Witbank).—2s. 3d., payable Aug. 15.

†South Witbank Coal Mines.—12½%.

***Southern Malayan Tin Dredging.**—4d., payable Aug. 22.

***Springbok Colliery.**—7½d., payable Aug. 15.

†Sungei Kinta Tin Dredging.—1s., payable Aug. 20.

†Tanjong Tin Dredging.—1s., payable July 31.

***Transvaal Consolidated Land and Exploration.**—2s., payable Aug. 7.

†Transvaal Navigation Collieries.—9%, payable July 27.

***Tronoh Mines.**—4d., payable Aug. 8.

***Tweefontein United Collieries.**—1s. 4d., payable July 30.

***United Steel Companies.**—4%, payable July 22.

***Vereeniging Estates.**—3s., payable Aug. 19.

***Vryheid Corporation.**—9d., payable Aug. 15.

***West Rand Consolidated Mines.**—Deferred, 113s. 4d., payable Aug. 7.

***West Witwatersrand Areas.**—1s. 7½d., payable Aug. 8.

***Western Mining Corporation.**—6d. Aust., payable Aug. 8.

METAL PRICES

July 9.

Aluminium, Antimony, and Nickel per long ton; Chromium per lb.; Platinum per standard oz.; Gold and Silver per fine oz.; Wolfram per unit.

	£	s.	d.
Aluminium (Home)	180	0	0
Antimony (Eng. 99%)	190	0	0
Chromium (98%–99%)		7	2
Nickel (Home)	600	0	0
Platinum (Refined)	25	0	0
Silver		6	3
Gold	12	10	4
Wolfram (U.K.)		—	
(World)	3	5	6

Tin, Copper, Lead, Zinc } See Table, p. 48.

Asbestos in a Modern Rôle

W. E. Sinclair, M.I.M.M.

Blended with other materials the fibrous mineral finds many new industrial uses.

Introduction

In this age of phenomenal expansion industry demands not only advanced productive technology but materials that possess the vital characteristics necessary to achieve effective results in a keenly competitive field. Asbestos possesses a number of outstanding natural properties, particularly incombustibility and fibre strength, and it is understandable that it has become essential in the manufacture of certain specialized products.

The need for strength is generally of first importance in most engineering materials and strength is possessed by most varieties of asbestos. Indeed, in some cases, crocidolite in particular, the tensile strength of the fibre strands varies from 100,000 lb. per sq. in. to 300,000 lb. per sq. in., which compares favourably with steel wire. However, the combination of strength and incombustibility makes the material absolutely durable, the fibres being unaffected by the elements and immune to the effects of sea water. Indeed its resistance to heat and weathering tends to make the material everlasting.

Another valuable property possessed by the amphiboles—crocidolite and amosite—in special products is their quality of being resistant to acids and alkalies. At the same time their resistance to heat, indicated by the fact that the loss of weight when subjected to high temperatures is infinitesimal as compared with any other fibres, provides those attributes desirable in asbestos-cement pipes used for the conveyance of chemical solutions or other corrosive liquids.

Again, the use of blended asbestos products in electrical appliances and as insulating media is a fairly common application of nonferrous chrysotile asbestos.

Having so many valuable inherent properties it is natural that manufacturers will endeavour to use asbestos in all specialized products when they can. Unfortunately, however, as a secondary fibrous mineral without rigidity, asbestos itself has but a limited range in competition with anything but textile products. This disability, however, is overcome by the combination of the fibres with some material having a rigid physical quality. As a filler or reinforcing medium

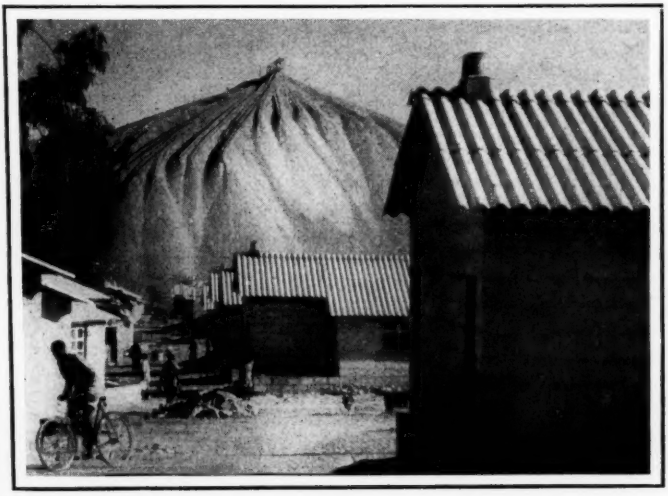


Fig. 1.—Corrugated Asbestos-Cement Roofing on Native Houses in Rhodesia.

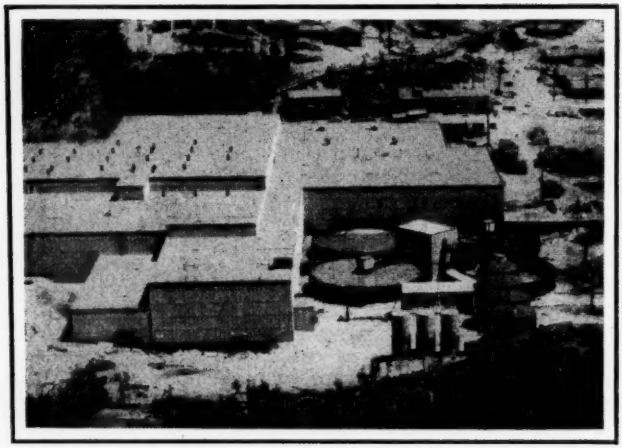


Fig. 2.—Mine Plant in Ontario Entirely Asbestos-Cement Clad.

blended with other materials the asbestos not only supplies strength to the finished product but provides the other qualities it alone possesses.

Asbestos in Plastics

Incorporated in plastics asbestos plays an important part in very many manufacturing branches of industry. Many applications for asbestos-reinforced plastic products have been found for example in modern jet engine and rocket designs where unusually high tensile and flexural strength at elevated temperature are essential. In this same sphere the use of asbestos in the field of plastics is extending its application to a variety of specially designed building materials. Phenolic-asbestos products replace metal tanks in aircraft, while in the form of felt or laminates (impregnated with certain resins) they are also used for other aircraft parts. Such fabricated sections are light and strong and unaffected by extremes of temperature and humidity. It is shown that glider wings and scanner aerials constructed from phenolic-asbestos products are as strong as and stiffer than an aluminium alloy of the same profile, which actually would weigh twice as much as the plastic product.

A recent innovation is an asbestos board product which is a satisfactory substitute for wood. It is workable as wood and is absolutely fireproof. The material is made of amosite asbestos blended with a selected grade of silica bonded together under heat and pressure. The product is not only fireproof but is strong and light and possesses good insulating qualities.

With asbestos as a basic component in any product it is the supporting fraction combination that enables the most valuable properties to be effectively utilized successfully and economically for many wooden or metal appliances. The best known example of this combination of physical values is in the field of asbestos-cement fabrication. Such products have for many years played an important part in replacing wood and iron in various forms in building construction. The materials now being used are found to be beneficial simply because they are impervious to extremes of temperature either when used in the wintry conditions of the arctic regions or the heat of the tropic zones. In either case the products weather well and need no paint as a protection, no matter how high the humidity, while their insulating qualities are of equal importance. Figs. 1 and 2 illustrate materials used in these conditions. The more common forms taken by the asbestos-cement building products are corrugated sheets or shingles for roofing and flat sheets or boards for side walls, *plus* all the necessary accessories—such as, ridging, guttering, piping, and various other fittings that replace the usual ironwork.

Although decided advance has been achieved in the fabrication of asbestos-cement products for special uses the general process in its simplest form remains essentially unchanged. This consists of mixing the main constituents, asbestos and Portland cement, in water in certain proportions. Generally the standard mixture consists of from 15% to 20% of asbestos to 85% to 80% of cement. If special qualities are demanded

of the finished product the proportions may be altered, even to reversing the usual ratios, when specially flexible sheets are required.

The fibre used must possess certain essential physical characteristics necessary to ensure the best qualities in the finished product. The most important of these are fibre length (about ½ in.) and strength and texture. The fibres are fully opened up (fiberized) to remove all trace of dust and grit in order that a truly homogeneous pulp can be mixed and each individual fibre thoroughly coated with the liquid cement. The harsh and shaggy texture of the fibres and their hygroscopic quality assist in the effectiveness of the wet mix.

Crocidolite asbestos is generally considered to be superior in this field and it has the advantage also of being highly resistant to the corrosive effect of acids.

High-Pressure Products

The utilization of asbestos-cement products in specified applications has in recent years brought about marked advances in manufacturing techniques and more especially in the production of high-pressure pipes. These now successfully replace iron piping as water mains in every imaginable field, including water reticulation underground in mines. Fig. 3 is a view of a water main underground. The manufacture of piping from 2 in. to 24 in. in diameter capable of standing pressures up to 175 lb. per sq. in. is now standard procedure for the conveyance of water, chemical solutions, sewage, or gases. In some cases special acid-resisting piping, vats, filters, and various other chemical manufacturing requisites are now provided for by asbestos-cement products.

There is little change in the proportional mixture or fundamental processing in the fabrication of seamless high-pressure piping. The appliances used in the processes, however, have assumed quite startling developments in the wet mix process. In pipe manufacture the main item is the forming machine. This is essentially a revolving mandrell (inside a casing) the movements of which are hydraulically and electrically controlled. The cylindrical form has a diameter equal to the final outside diameter of the pipe, thus ensuring a regular and uniform thickness of the finished product.

In using this machine the liquid cement and asbestos mixture of high viscosity flows through specially prepared channels on to a screen of phosphor bronze from which it passes into the mandrell. Pressure is then applied to build up a tough and dense homogeneous mass. This is aimed at imparting complete cohesion to the successive layers of the asbestos-cement mixture until the desired thickness has been secured. After removal of the mandrell and the built up pipe from the machine the mandrell is withdrawn after setting and the pipe then immersed in water for two weeks' curing. Finally the finished pipe is matured in the open air.

These pipes are made to stand working pressures up to a 400-ft. head of water under

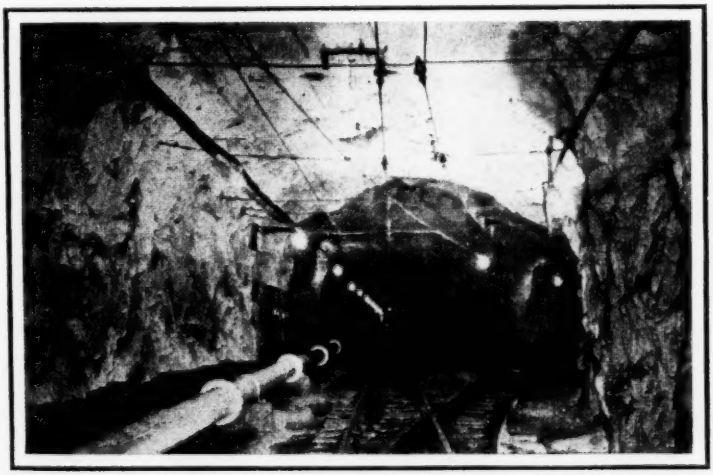


Fig. 3.— High-Pressure Asbestos-Cement Pipes Underground.

Fig. 4.—Original Factory near London for the Manufacture of Asbestos-Cement Products.

the most arduous conditions and therefore are subjected to stringent tests before being used. Besides the usual hydraulic tests carried out at twice the recommended working pressure the finished material is subjected to laboratory bursting tests by the factories. In addition Government tests, usually carried out by the South African Bureau of Standards, consist of a vigorous check to ensure that the product conforms fully to standard specifications.

Standardization ensures a high-quality material characterized by strength, toughness, and flexibility, *plus* working effectiveness equal to any metal pipe. As reinforcing agents the asbestos fibres are analogous in their action to steel reinforcement in concrete structures, with the advantage that the fibres are intimately mixed with the cement, thus providing a uniform mass of constant strength throughout the body of the product. Any pronounced difference in stress and any possibility of lack of bond between the cement and the asbestos is avoided by these modern improved processing methods.

The significance of these factors is clearly proved in the successful application of asbestos-cement pipes in different installations under many varying conditions. The resiliency of the pipes is particularly effective in withstanding breaking strain or stress when subjected to movement due to subsidence of the ground supporting them. The imperceptible flexibility allows the line to conform to reasonable settlement without cracking or leaking. Similarly, used underground, supported at regular intervals, any movement caused by the effects of blasting, for instance, is effectively taken up without damage.

In using these pipes underground several outstanding advantages are apparent. First, in 10-ft. lengths they are lighter and more easily handled (especially in confined spaces) than long heavy iron piping. Improved monolithic sockets are simple, effective, flexible, and quickly and easily applied. These joints, besides the pipes themselves, are non-incrustating and durable. Also a vitally important point is the fact that asbestos-cement pipes are non-conductors of electricity and therefore a safeguard against electric shorts or lightning.

In special installations where chemical solutions or gases are conveyed resistance to the corrosive action of the liquid is positive and the pipes are unaffected by extremes of temperature and are immune to electrolysis.

Steel and wood, as railway sleepers, have generally been a costly maintenance item in railroad upkeep because of their inability to stand up to extremes of weather, permafrost, or swampy conditions and varying temperatures and the attacks of insects. It seems more than likely that asbestos-cement sleepers must ultimately prove the most satisfactory substitute.

A New Electromagnetic Dip Indicator

A borehole-survey instrument developed in Sweden is briefly described

Most bore-holes are designed to be straight and are usually approximately so, given a machine in good condition and a well-trained driller and a hole more or less at right-angles to the " grain " of the country. The human conditions should be relatively easy to control, whereas those imposed by nature—marked and irregular variations in composition, attitude of bedding or foliation planes, excessive jointing, and so on—tend to encourage diversion and are often difficult if not impossible to circumvent. Many cases are on record of wildly aberrant holes, but to-day, when reliable survey instruments are available, there is less excuse, provided that surveys are done sufficiently early and often so that corrective measures may be applied. In fact the application of such corrective measures has led to diversions purposely made to hit a target more than once from a single hole. It is desirable to know the whereabouts of the boring at the desired points. It may be said that in general a hole that keeps within a cone of about 5° radius is usually acceptable, though even with this amount of deviation a hole may be difficult to locate in deep workings—and it is only in excavations that positive proof is obtained.

The design and the reliability of bore-hole survey instruments varies considerably and even to-day some people have a touching faith in the old method of the hydrofluoric acid bottle which even at best is trustworthy to but a degree or so for inclination and provides no clue as to direction. Modern instruments include those utilizing photographic records of the position of a pendulum, or chemical, magnetic, electrical, and gyroscopic means, either alone or combined ; all may be used for single or multiple shots or for more or less continuous recording.

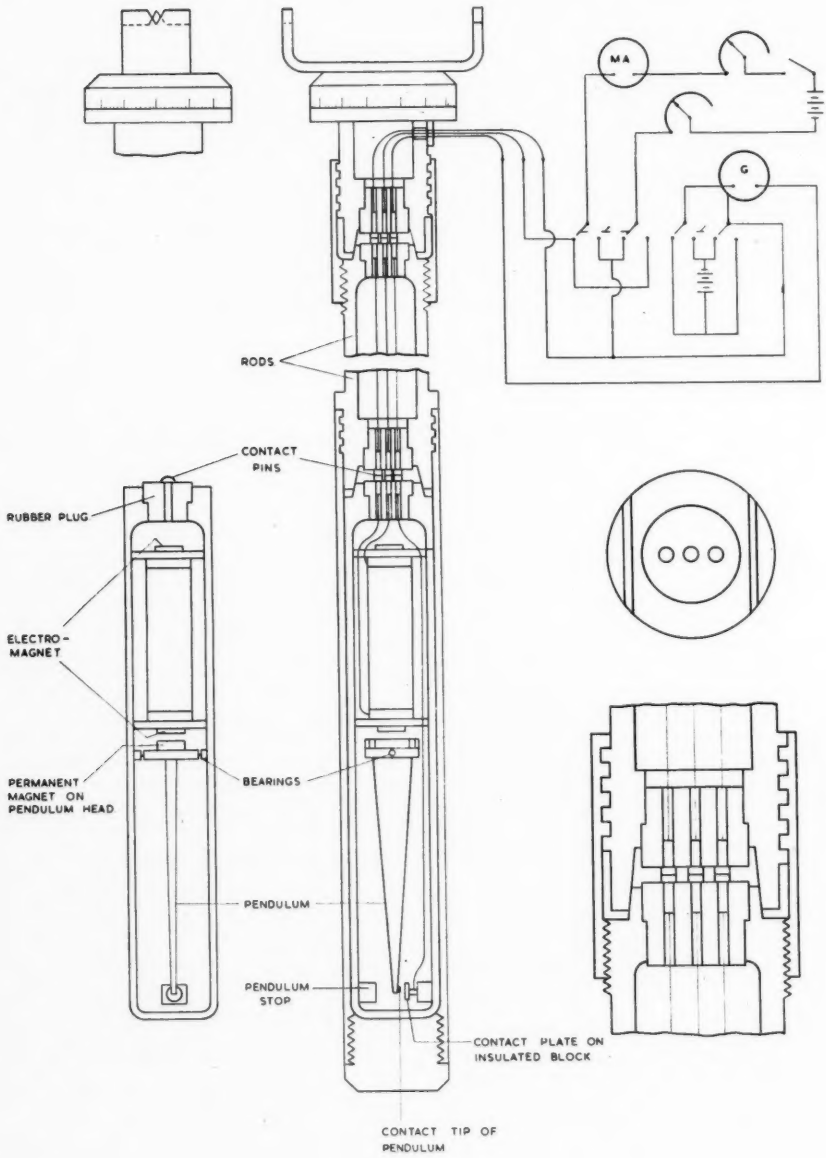
After considerable experience with several types of survey instruments the Swedish Diamond Rock Drilling Company instituted a research programme from which the Craelius Electromagnetic Dip Indicator has been evolved, largely on the work of E. Roxström. The basis of this instrument is a pendulum free to move in one plane only in which the influence of gravity is compensated and measured by electrical means, the whole being part of a signalling circuit registered at surface, as will be seen from the accompanying figure. The inclination of a boring from vertical to horizontal is thus measured and recorded in any one plane. In order that measurements may be made in other planes the instrument is turned full circle the maximum reading being obviously the greatest inclination. This and the orientation as a whole is accomplished by the use of Kiruna-type orientation couplings between the drill rods. Such couplings are marked so that they may be quickly joined and orientated mechanically and electrically in a certain direction, which may be controlled and measured on a diopter head graduated in degrees and fitted into the lower half of an orientation coupling on the highest rod. Before use the instrument is calibrated for various positions both vertically and between the vertical and horizontal.

The salient features of the instrument are as follows :—

The instrument for insertion in the bore-hole is only $1\frac{5}{16}$ in. (33·5 mm.) in diameter. It is, therefore, ideally suited to very slim holes but it can be operated equally effectively in wider holes by using a mounting of appropriate size. Its short length—minimum 16 in. (40 cm.)—almost precludes chances of jamming in crooked holes, except in the unlikely event of a remarkably sharp bend.

The presence or otherwise of casing or of magnetic ores of any kind does not affect the reliability of the instrument.

The time spent in operation is much shorter than with most other instruments. For example, a 1,000-ft. boring is generally completely surveyed and the equipment removed within 8 hours from the time of arrival. This is partly due to the fact that surveying can proceed continuously and



Electromagnetic Dip Indicator.

without the interruptions necessary in other methods for resetting of instruments, changing chemicals or films, and so on.

Very aberrant holes, of course, take longer. Moreover, in deep curved holes friction between wall rock and rods may cause a certain amount of lag when the instrument is turned full circle and thus upset the predetermined relation between the "compass bearing" of the diopter head and the orientation plane of the instrument in the bore-hole. This is easily corrected by turning the rods first clockwise as usual and then anticlockwise, for the friction may be assumed to be similar in both directions; the lag interval shown on the plotted graphs is then bisected.

The maximum depth so far surveyed is 3,000 ft., but there is no real reason why the instrument should not be used for deeper holes provided they are reasonably steep and not unduly kinked.

The results obtained by the Craelius instrument show up very favourably when set against those of theodolite surveys where holes have been intersected. For example, with a nearly vertical hole of 350 ft. the difference between the position calculated from the Craelius results and that of the mine survey was less than 5 cm.

A New Mineralogical Laboratory in the United States

A description of a research station recently opened in Florida

What is considered to be a major step toward advancing knowledge of minerals as a source of power has been undertaken by the International Minerals and Chemical Corporation at its Mulberry, Florida, Research Station. Here it has assembled a concentration of trained specialists and equipment claimed to be unparalleled anywhere in the United States. The newly completed mineralogical laboratory, which will house the group, is designed principally to supply facts about every phase of minerals investigation, from the composition of newly-discovered ores to the economics of successfully mining and marketing them. Its facilities include a wide range of analytical equipment providing for differential thermal analysis, X-ray diffraction, spectography, and high-powered microscopic studies.

An example of how the Florida Research Station performs for the benefit of the operating divisions of the company is the work completed on a feldspar project for the Industrial Minerals Division of the Corporation. At its Topsham, Maine, plant that Division produces a grade of feldspar used in the manufacture of glass and ceramics. The ore, crushed to eight mesh, contains 75% feldspar, 23% free quartz, and a desirable alkali ratio of potash to soda. Seeking an expanded market for its material, I.M.C. received encouragement from the porcelain insulator manufacturing industry if its feldspar could be produced at required specifications. It meant reducing the ore's feldspar content to about 70% and the free

New Equipment in Use.

View of the Research Station.

quartz content to about 5% without disturbing the favourable potash-soda ratio. Scientists at the Experimental Station were given the assignment with these questions to solve : Could this product be produced at the Topsham plant? Could it be done economically and, if so, how?

Analytical studies conducted in the mineralogical laboratory first confirmed that there was enough free quartz in the ore concentrate to permit reducing it by 20%. The laboratory determined the mesh size to which the ore would need to be crushed in order to meet the specification. Next, the mineral group had to determine what weight of ore concentrate would need to be mined in order to produce the required grade of feldspar. They found the answer by batch testing the material through an electrostatic separator according to the LaBaron-Lawvir process. Very briefly this involves pretreating the material so that a positive charge is induced in one component while a negative charge is induced in another. It is then allowed to free fall through a field between two charged electrodes so that the components of the material distribute themselves according to a measurable pattern. Tests of this kind were conducted repeatedly to achieve the desired results.

From these findings a pilot plant was designed to run at the rate of 200 lb./hr., which proved that similar results could be consistently produced under full-scale commercial conditions. The pilot plant also helped in the design of the actual installation at the Topsham plant. In addition to answering the questions originally posed the research indicated ways of reducing mining costs and demonstrated effectively how other ores of interest to I.M.C. might be upgraded.

This case emphasizes the mineralogical services provided by the research station to I.M.C. operating divisions, but it is equally active in solving problems related to inorganic chemical research and chemical processing.

Thorium Recovery Plant in Canada

What is believed to be the world's first thorium recovery plant is to be erected by Rio Tinto-Dow, Ltd., on a site adjacent to the Algom Quirke mine, at Blind River, five miles north of Elliot Lake. The contract for the engineering and construction has been awarded to Humphreys and Glasgow (Canada), Ltd., and it is expected that plant operations will be underway by January, 1959, with the plant operating at capacity by May, 1959. In the past year, it is stated, Humphreys and Glasgow have already undertaken two contracts for Dow Chemical of Canada—one a new chlorine-caustic soda unit and the second a methyl chloride unit.

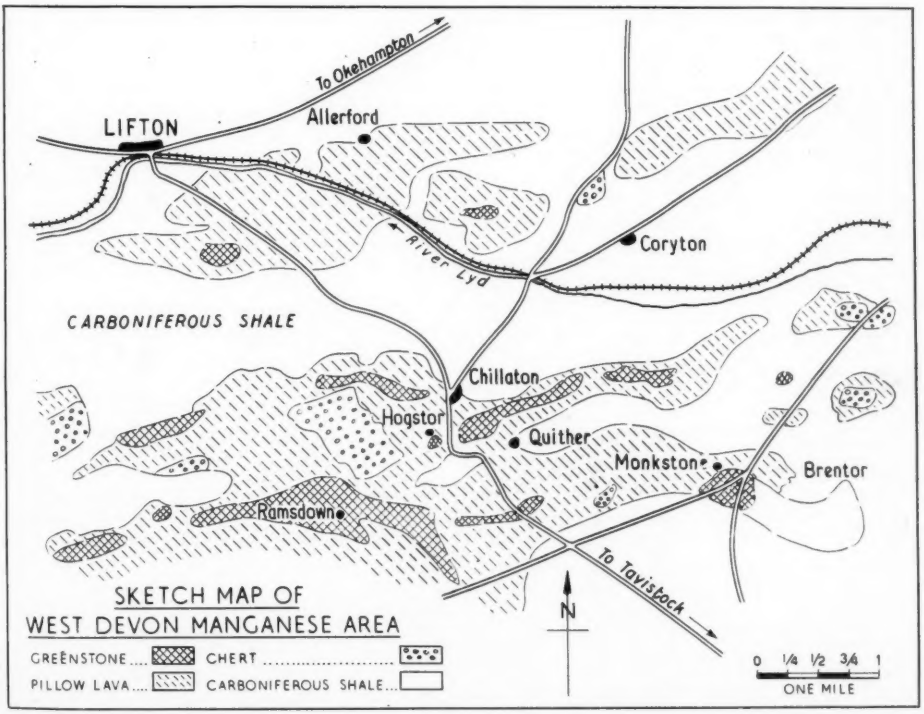
Manganese in West Devon

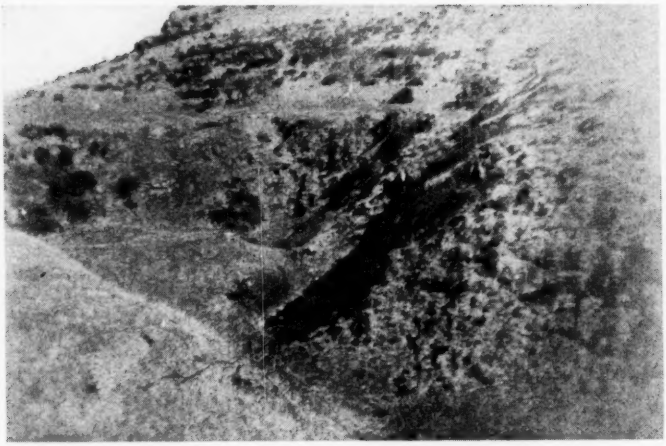
R. W. Toll, A.M.I.M.M.

A brief account of past mining activities.

It is usual, perhaps, to associate Devon and Cornwall chiefly with the mining of copper and tin but from time to time a number of other metals have been extensively worked and the production of manganese in West Devon was, during the latter part of the 19th Century, of considerable importance. At the time of the introduction of the Bessemer process for steel production a demand arose for manganese for the manufacture of various types of steel and for a while the domestic demand for manganese was satisfied by these Devon ores. Added to this demand the expanding chemical industries required increasing supplies of manganese dioxide for the production of chlorine gas by the Weldon process, this gas being used for the production of the bleaching powder then in great demand for use in the cotton industry.

The chief producing area for manganese in West Devon was to the north of Tavistock near the villages of Chillaton and Brentor. The ores produced were pyrolusite and psilomelane and occasionally the silicate ore rhodonite. The deposits occurred adjacent to extensive intrusions of greenstone and were often accompanied by chert, especially in





Open Manganese Working at Brentor.

the Carboniferous slaty rocks immediately to the north of the Devonian beds of the Gunnislake and Tavistock mining area.

The manganese deposits occur as very irregular masses of varying size and in most cases the orebodies were shallow; many chance discoveries were made during the ordinary agricultural pursuits of draining, ploughing, etc. This resulted in the mining area being scattered, with a number of small workings where masses of manganese were mined by primitive methods of bucket and windlass or by shallow cuttings and adits.

The largest workings were at Hogstor, near Chillaton, where over 50,000 tons of ore was produced. Other mines on a fairly large scale were at Monkstone, near Brentor, the Coryton mine, Dippertown, and Ramsdown.

The methods of mining were, as already noted, simple and the absence of engine houses indicate that the horse whim was the chief method of hoisting. As the ore occurred in irregular lenses no particular system of mining was adopted and much reliance was put in the self-supporting properties of the enclosing rock. At the Hogstor mine, however, large excavations were made and in some cases the workings had to be back-filled to prevent subsidence.

When brought to the surface the ore readily lent itself to hand picking, the black manganese ore being easily separated from the light-coloured slate and chert usually associated with the manganese ore. The fines and dredge ore were treated by jigging and the finest portions buddled, as was the usual practice with copper ore at that period.

Where the ore was prepared for the

Old Manganese Mill House at Morwellham.

Millstone for Manganese Ore at Morwellham.

chemical industries it was ground by means of mill stones to a fine powder and packed in casks. This final process was carried out at manganese mills, which operated in valleys where water power was available and a number of these mills were employed often at some distance from the mines. The principal mill was situated at Morwellham, on the River Tamar, where extensive copper-ore quays dealt with the output of copper ore from the mines of the Tavistock district.

At Morwellham a special manganese dock was provided and the mill was operated by a 30-ft. water-wheel driven by the overflow of the Tavistock–Morwellham canal. The manganese mill was kept running on a three-shift system, grinding the ore from the Hogstor and other mines in the Chillaton area, which were conveyed by teams of horse-drawn waggons. From Morwellham the ground ore was loaded on to sailing vessels which were taken down the Tamar by steam paddle-wheel tugs to Plymouth and then set sail for Merseyside and South Wales, the vessels duly returning with coal for the copper mines. For many years a prosperous traffic was carried on until towards the latter part of the 19th Century the ever-increasing supplies of foreign ores put the West Country mines out of production.

The manganese district of West Devon has never been systematically examined in the light of modern methods and it is an area where shallow bore-holes could be used to great advantage and the chances of discovering further bodies of manganese would appear to be good.

Aiding the Great Lakes Ore Traffic

The work of deepening the passages between the Lakes has speeded ore flow

J. Grindrod

With the deepening of the connecting channels between the Great Lakes of North America to 27 ft.—initiated by the U.S. Corps of Engineers in the 1956–57 fiscal year and for which Congress appropriated $13,000,000 for the year beginning July, 1957—considerable help will be given to the vast traffic in iron ore between the mines of the

Lake Superior area and the steel mills of South Chicago, Detroit, the Lake Erie region, and the Youngstown–Pittsburgh area. Other principal commodities carried by this inter-regional traffic are coal, limestone, petroleum, and grain, the commerce on the Great Lakes constituting about 25% of the total water-borne trade in the United States, including all ocean ports and inland waterways.

Expected to cost about $150,000,000 in all, this channel-deepening project has been brought to a head by the scheduled completion of the St. Lawrence Seaway from Montreal to Lake Erie for the opening of the 1959 shipping season, although the deepening of the inter-lake channels is not expected to be completed before 1962 or 1963. Immediately following the deepening of the connecting channels, and probably to some extent concurrently with this work, a major programme of harbour deepening is also to be put in hand to provide suitable accommodation for the deeper-draught vessels that will then be able to operate on the Great Lakes services.

Of the traffic in the three basic commodities—iron ore, coal, and limestone—required for the production of iron and steel that of iron ore is by far the largest and is, in fact, the largest traffic in any single commodity carried on the Great Lakes. Although the known reserves of high-grade direct shipping iron ore in the Lake Superior region are not sufficient to sustain the present high rate of production indefinitely, current developments for producing taconite concentrates, coupled with the tremendous reserves of low-grade ores from which such concentrates are obtained, are expected to maintain the Great Lakes ore traffic at a high rate. It is believed that any decrease in the production and shipment of high-grade direct shipping ore will in large measure be offset by the increased production of such taconite concentrates and by the development of other sources of high-grade ore in the region.

All the iron ore from Lake Superior to the United States ports passes down the St. Marys River to Lake Huron. Part then goes through the Straits of Mackinac to the South Chicago steel producing area on Lake Michigan, the remainder going to Detroit and Lake Erie ports through the St. Clair River, Lake St. Clair, and the Detroit River.

Coal traffic on the Great Lakes has been maintained at a high rate and is expected to increase in the future. In spite of the fact that coal has been replaced to a large extent by gas and oil, both for domestic and industrial use, it is expected that there will continue to be an increase in the use of coal as fuel for industry and for electric power production. Most of the traffic in coal goes in

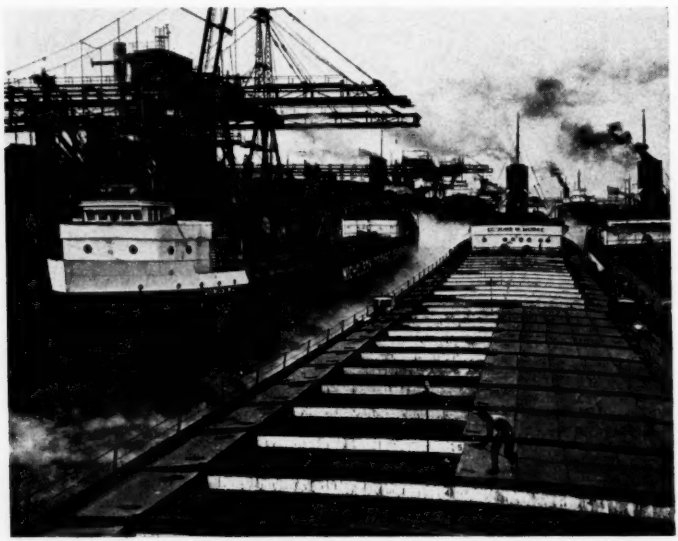


Fig. 1.—Iron-Ore Boat Docking at Buffalo, N.Y.

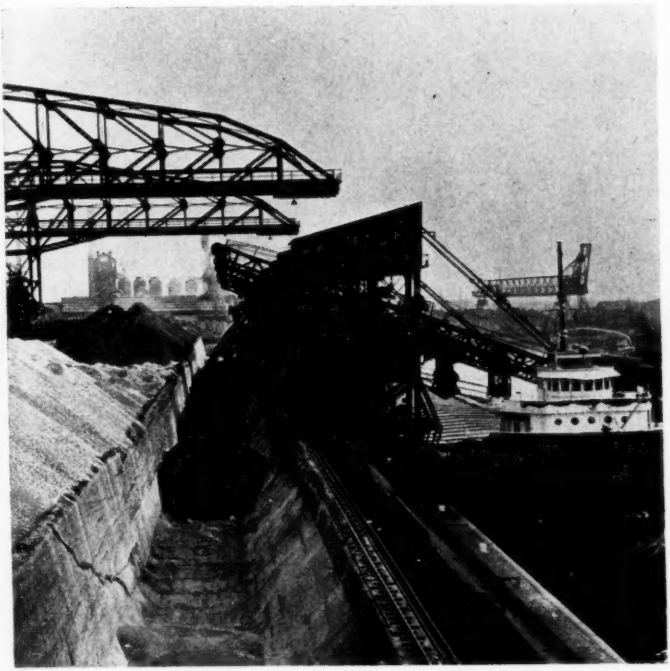


Fig. 2.—Ore Carrier Unloading at Chicago.

a westerly and northerly direction from the Lake Erie ports through the connecting channels to ports on Lakes Huron, Michigan, and Superior.

From the vast deposits of limestone along the shores of Lakes Michigan and Huron this commodity is carried easterly and southerly from the quarries, much of it moving through the connecting channel between Lakes Huron and Erie. The traffic in limestone has shown a steady increase in recent years and the trend is expected to continue. In addition to the large quantities required for steel making it is also wanted for construction purposes and for chemical processing.

Work involved in the channel deepening plan will fall into five main sections: The St. Marys River section, between Lake Superior and Lake Huron; the Straits of Mackinac section, between Lake Michigan and Lake Huron; the St. Clair River section, between Lake Huron and Lake St. Clair; the Lake St. Clair section, and the Detroit River section, between Lake St. Clair and Lake Erie. It provides for increasing the controlling depths of up-bound channels from 21 ft. to 27–30 ft. and down-bound channels from 24·8 ft. to 27–30 ft. These recommended depths will increase the safe draughts for lake vessels from 22·3 ft. to 25·5 ft. in down-bound channels and from 18 ft. to 25·5 ft. in up-bound channels when the ruling lake level is at its low-water plane.

During the years improvements in channel depths have been made from time to time and these have been followed by corresponding harbour developments. With the deepening of the channels, also, shipowners have increased the draughts of their vessels to take full advantage of such improvements with the effect that some of the more recently built ships have been up to 710 ft. in length, up to 75 ft. in beam, and with maximum draughts of from 24·5 ft. to 26·9 ft. There are, in fact, about 50 vessels in the Great Lakes fleet which can load to draughts of 24·5 ft. or more. Some of these vessels under present conditions can only load to reduced draughts except during the relatively short

periods when lake levels are at extreme high stages.

Not only will the deepening of the connecting channels be of great benefit to these existing vessels, but it will be important in respect of the planning of new ships to take the place of the many older smaller craft which are nearing the end of their useful lives.

Ore-Dressing Notes

(1) *Handling.*

Selecting the Conveyor-Belt

Two articles by R. E. Spoerl[1] some time ago gave particulars and valuable tables designed to enable the purchaser of a replacement conveyor-belt to select the correct belt for the load to be handled. The three fundamental factors which govern selection are capacity, drive horse-power, and belt tension. The information needed to choose the correct belt include the load characteristics—weight of material in lb. per cu. ft., maximum size of lumps, and size range and physical condition of ore; maximum rate of feed (peak loading); centre to centre distance between belt head and tail pulleys; lift or drop of belt; drive arrangement; take-up arrangements, and loading and discharge arrangements. Capacity is determined by (*a*) the nature of the load including weight, (*b*) belt width, and (*c*) speed of belt travel. The belt should always operate as fully loaded as possible and at maximum permissible speed in order to achieve minimum cost. Ores vary in weight (lb. per cu. ft.) from that of bauxite at 75 through copper ores at 125, up to pure galena at 465. It is, therefore, important to establish the weight per cu. ft. for the specific material to be handled. The author gives a table relating belt width to weight of material and tonnage handled per hour under various conditions. Speeds vary from some 300 ft. per min. for moderately free-flowing material up to 500 ft. or even 600 ft. per min. as the belt widens from 12 in. to 72 in.; calculations must allow for peak loading, not average loading. The maximum size of material fed to the belt is one determinant of the minimum width of the belt which can handle that size. It varies from a maximum of 2 in. feed on a 12-in. belt up to 35 in. feed on a 72-in. belt when mixed with fines or 18 in. when uniform in size.

The total horse-power calculations must include "level" horse-power, "vertical" horse-power, and that needed to operate the tripper if one is included. This is the motor horse-power required to operate the belt conveyor, together with whatever percentage is needed for loss through speed reduction units. With a horizontal or climbing system the motor drives only the belt and its load. In descending conveyors it may be needed to overcome static friction and start the belt load moving or it may be even required to act as a restraining brake on the system. The angle of climb of a conveyor line depends on several factors. Irregularly shaped material has less tendency to roll back than has smooth symetrically shaped rock and, therefore, can be taken more steeply up. Large lumps move best up steep slopes when imbedded in plenty of fines. Wet material tends to slide back, but slight moistness may be of help. When steep inclines must be used moderate belt speeds and uniform controlled loading on to a horizontal stretch of belt is desirable. Broadly the maximum safe angle of rise is between 10° and 15° less than the materials angle of repose. The total belt tension must be calculated in order to determine the type of fabric and the number of plies required in the carcass. This includes the effective tension, which is at its greatest as the belts runs over the drive pulley, the slack side or return-run tension, and the return slope tension.

The belt carcass is its body and consists of a varying number of rubber impregnated fabric plies. These may be stiffened in various ways by incorporation of cords and of organic or metallic material. The belt cover is the rubber envelope protecting the carcass and it must have enough thickness on the carrying side and on the bottom and edges to withstand the duty required. This brings in considerations of the maximum tension, the impact of the load where fed on to the belt, and where slipping during carriage. There must also be crosswise flexibility in order to trough properly. The maximum permissible working tension is the stress which a single ply of fabric can withstand and is measured in pounds per inch of belt width. The fabric must stand up to impact, stretch, and moisture. Pulley diameters must also be considered

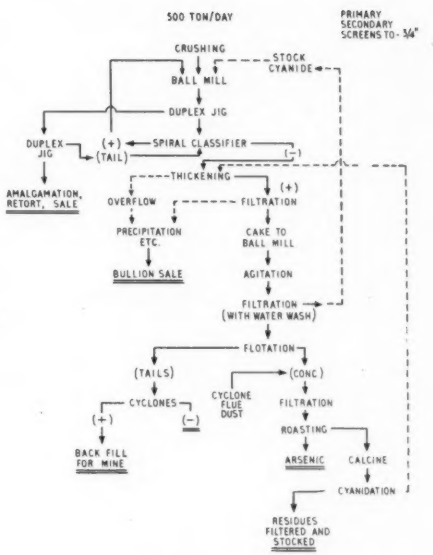
[1] *Engg. Min. J.*, May, 1957; July, 1957.

as the thicker the belt the greater must be the diameter of the pulleys. The more abrasive the ore, the greater the chance of it coating pulleys or sticking to the back of the belt, the thicker must be the pulley side cover. When the length is being ordered it must be twice the centre to centre distance *plus* the length needed to make the splice and to accommodate drive, terminal snub pulleys, bends, trippers, and take-ups. Up to 1% should be added to the resulting calculation to allow for contingencies. Spare belts should be stored in an upright position in a cool dark place. When they are being moved this should be in the direction in which they are rolled. Belts should not be dropped or moved by steel bar. They must not be fixed round bends sharper than the minimum pulley diameter recommended. When installing a new belt all the structure, pulleys, loading devices, etc., must be checked and brought into first-class condition. After this the belt is laid out properly and mounted squarely and pulled into position by block and tackle or winch. If it is being loaded on to troughing rollers this should be from the top of the roll and if on to the return idlers on to the bottom of the roll. The belt must be kept taut during this operation to prevent excessive unloading or telescoping. It must be unwound slowly and not kinked. It is then trained and the pulleys are checked together with the loading chutes and discharge devices for alignment. If skirt boards are used they should be of rubber, not of old belting. Starting and stopping of a belt conveyor should be gentle. There should be a minimum angle between the stream of arriving material, the belt, and a minimum drop. Fines should come on first and form a cushion for the heavier larger lumps. Loading should be on a horizontal belt section.

(2) *Production.*

Gold, Canada

The Con mine mill treats 500 tons daily of an ore containing gold, arsenopyrite, pyrite, sphalerite, and stibnite in quartz. The original mill went to work in July, 1938, at 100 tons/day and was the first to operate in the Canadian N.W. Territories. A flotation stage was added in 1940, when auriferous sulphides were encountered. As the accompanying flow-sheet shows, gravity treatment on jigs is followed by completion of the cyanidation commenced in the grinding



Con Mill Flow-Sheet.

circuit and the tailings are floated, calcined, and cyanided, the main flotation tails being deslimed and sent to the mine for back fill. Some 23½% of the gold is recovered by amalgamation of the jig concentrate, 50½% in cyanidation, and 15% in roaster production.

(3) *Cyclones.*

Selection for Plant Use

A comprehensive symposium on cyclones held in South Africa in 1956 has often been referred to here. A further cyclone symposium formed part of the A.I.M.E. Minerals Beneficiation section of the New Orleans meeting reported in *Mining Engineering* for August, 1957. Between them these collections of papers give the mill engineer a broad survey of current knowledge and practice. The paper by E. C. Herkenhoff, "Selecting a Cyclone for Wet Classification," should be particularly useful to anyone preparing to use these appliances. There are three main applications—open-circuit work on variable feed classified into sand and slime, open-circuit operation on variable feed with constant sizing of one product, achieved by adjustment either of the apex or of the vortex aperture, and closed-circuit treatment to give constant sizing at release mesh. The last is the usual mill requirement.

For coarse classification in the *minus* 20 mesh range the feed should have a high pulp density and low pressure and be delivered to the larger type of cyclone with a wide included angle and an apex set for high-density underflow. For fine classification pulp density should be low and feed pressure high. Small cyclones, small vortex finders, and low included angles are used with low-density underflows. For desliming (or desanding) a dilute feed, low overflow and high underflow density, and two-stage treatment of the important product by repulping and recycloning is recommended.

The information required before specific selection includes the proposed rate of dry feed and its dilution in the pulp ; the expected circulating load if in closed circuit ; the product which must be tightly controlled (overflow or underflow) ; the proposed subsequent treatment ; the mesh of separation ; limitations on densities of pulp entering and leaving ; specific gravity composition, shape, and size range of feed ; fluctuations in feed ; method of imparting feed pressure ; pulp temperature, and some minor points. Kerkenhoff recommends pilot tests on the plant, using cyclones comparable in size to those which the foregoing data suggest for established operations, rather than working up from miniature tests and extrapolation. The enormous volume of literature already in existence probably contains a description of use in analogous circumstances, but one virtue of cyclones is their adaptability to wide ranges of working conditions.

The choice of a cyclone or a multiple assembly depends on the gallons per hour to be handled and the pulp density. Capacity is a function of sizes of inlet, vortex finder, apex opening, and feed pressure. The Dahlstrom capacity formula does not equate all of these factors and must therefore be modified. The nature of such a modification depends on whether the principal restriction of flow is at the feed entry or at one or both of the discharge openings. Herkenhoff gives tables calculated from published data, from which the cyclone dimensions can be approximately derived. Most manufacturers offer a range of cyclone sizes and a range of apertures for each size. If choke-up occurs it will be at the apex, after which the whole of the feed leaves *via* the vortex finder. The underflow density is therefore an important factor, since if this is made too high efficiency deteriorates and choking may take place.

Book Reviews

British Coal Mining Explosives. By JAMES TAYLOR and P. F. GAY. Cloth, octavo, 175 pages, illustrated. Price 27s. 6d. London : George Newnes, Ltd.

The present work, designed as a compact reference book of " British Coal Mining Explosives " and written by men who have had comprehensive experience of their subject, fulfils an obvious need. It will help both engineers and explosives manufacturers and at the same time provide a useful text for mining students. The first four chapters summarize the development of coal mining in Great Britain, bringing its history, as far as the use of explosives goes, to the present day. " British Gallery Testing " and " The Law in Relation to Explosives for Coal Mining " are then reviewed before the design of modern detonators, including delay detonators, is explained. Then comes an account of the sheathed explosive and blasting combined with water infusion, followed by a discussion of the choice of explosives for use in coal mines and a description of the various blasting devices of the Cardox, Hydrox, and Airdox types. The two final chapters cover open-cast mining and the actual mechanism of blasting. A useful work is rendered the more so by the comprehensive list of references given at the end of each chapter.

Mining Journal Annual Review, 1958 : A record of the progress of mining throughout the world. Paper covers, quarto, 328 pages, illustrated. Price 15s. London : The Mining Journal.

As usual this annual survey gives an authoritative account of the world's " metals and materials," going on to review progress in mineral exploration, underground and open-cast mining, mineral dressing and coal preparation techniques, and extraction metallurgy. Thereafter " The World's Mining Fields in 1957 " are in turn discussed, the usual " Progress Report on the Mines " completing a useful reference to have at hand.

Zinn und Wolfram : Die Metallischen Rohstoffe, Band 11, by F. AHLFELD. Cloth, octavo, 210 pages, illustrated. Price DM.48. Stuttgart : Ferdinand Enke Verlag.

The work under review discusses tin and wolfram in separate sections, that on tin, for

instance, occupying 123 pages and covering the history of tin, its modes of occurrence in nature and its genesis, mining and metallurgy, and a brief review of world occurrences. In the following 84 pages wolfram is covered similarly. Satisfactory in the geological sense, as would be expected of an author of such world-wide experience, the book although well documented, has little new to say of world occurrences. Nevertheless, it is a useful addition to a series of modern texts covering metalliferous raw materials.

Lehrbuch der Bergbaukunde : mit besonderer Berücksichtigung des Steinkohlenbergbaues. Vol. 2, 1958. By C. H. FRITZSCHE. Cloth, octavo, 611 pages, illustrated. Price DM. 34·50. Berlin : Springer Verlag.

This new edition of a well-known text on coal mining has been prepared with a wider scope, much more attention being paid to both ore and potash mines. As the preface points out the present book has not only been modernized in subject matter it is also set out differently. In the course of rewriting most of the illustrations of the earlier volume have either been replaced by new ones or entirely dropped, the aim being particularly to emphasize fundamental principles. The index has been revised and expanded and to those with a thorough knowledge of German the book will provide a thorough exposition of the subject.

Aluminium and Its Alloys in Electrical Engineering : A Symposium held in London, May, 1957. Paper covers, 370 pages, illustrated. Price 20s. London : Aluminium Development Association.

At this symposium a year ago 12 papers dealing with general and economic considerations, aluminium in transmission and distribution lines, and the use of the metal in electrical equipment were discussed in three sessions. The Symposium, with accompanying exhibition and demonstrations of jointing practice, took place in the Institution of Electrical Engineers, London, and the present volume of papers also contains the complete discussion, both oral and written, as well as considerable contributions from Italy and from the U.S.A. subsequently treated as extra papers.

☛ Copies of the books, etc., mentioned under the heading " Book Reviews " can be obtained through the Technical Bookshop of *The Mining Magazine*, 482, Salisbury House, London, E.C.2.

Engineering Log

Industrial applications of radioisotopes are on the increase ; industry is becoming increasingly aware of the cost savings and improvements in quality which are to be gained from their use. Radioisotopes—chemical products of the nuclear reactor which give off radiation—were employed by 18 users in 1946 and by 1,667 users in 1956. This sharp rise is partly the result of the development of facilities for producing artificial radioisotopes, particularly cobalt-60. They are now used by small and large industries to do work which either could not be done before, or which can now be done more economically by this method. The variety of applications is wide and appears to be unlimited, as far as finding new uses is concerned. Current uses include the study for research purposes of irradiated tools, pistons, or wire-drawing dies ; radiography, a substitute for the use of X-rays in inspecting steel castings or welded joints ; the making of gauges to measure the thickness of such products as steel, paint, rubber, paper ; tracers to follow the flow or movement of different substances in a process—for instance, the mixing of paint or the flow of oil in a pipeline—ionizers, to eliminate static electricity in production processes where friction has created problems—for example, in the textile industry—and polymerizers, or catalysts, to start or speed up chemical reactions. Radioisotopes are also used as radiators where a low-intensity light source is needed—for instance, to mark traffic lanes.[1]

* * *

Molybdenum disulphide is gaining increasing recognition and use as a lubricant in applications ranging from travelling cranes in steel mills, which work in high ambient temperatures and intense radiant heats, to the driving chains of industrial stokers. Its uses appear to be almost limitless in the fields of power production and utilization, since it withstands extreme pressures and high temperatures well and has a long life under both normal and unusual conditions. Highly adhesive and cohesive, molybdenum disulphide coats the surface it is protecting and completely eliminates metal-to-metal contact, substituting contact with the coating, which has a very low friction coefficient. In

[1] *Mod. Machine Shop*, Mar., 1958.

many applications wear which had been accepted as inevitable has been checked and operating and maintenance costs correspondingly lowered. In almost any application resistance to shock, heavy loads, high temperatures, and high speeds increases the duration of the lubrication cycle. No single formula is adequate for all problems, but molybdenum disulphide is available commercially in a wide range of carriers designed with specific applications in view and it is available in combination with graphite. One of the leading producers offers a list of 26 molybdenum disulphide lubricants, carriers including water lacquer, naphtha, resins, and mineral spirits. Pre-applied coatings in solid dry-film form are attracting attention. These allow of effective lubrication at almost no maintenance cost for an indefinite period and over a wide temperature range. Since the film strength is exceptionally high these coatings do not attract dust and dirt and are, in fact, remarkably resistant to it. This property, together with their ability to stand up to weather, makes them remarkably suitable for outdoor applications—such as, coal-handling machinery lubrication. Use of solid-film lubricants allows significant variations from common practice. For instance, the practice of avoiding the use of similar metals in plain and rubbing bearings can be disregarded since the coating, not the metals, will bear the contact, so that the hardest available metal can be used without regard for similarity of juxtaposed moving parts. Experimental results indicate that oxidation of MoS_2 in air begins slowly at about 750° F. and increases rapidly at 1,000° F. Since the products of its oxidation are the highly abrasive molybdenum tri-oxide, MoO_3, and sulphur compounds which react deleteriously with the metallic components of bearings, this can be dangerous. The danger can be avoided, however, by restricting the available oxygen and by using materials not affected by the sulphur compounds consequent upon oxidation. Friction tends to increase, however, with the formation of MoO_3.[1]

* * *

One of the deleterious effects of the extensive and still increasing mechanization of farming is the compacting of the soil by farm machinery. The correction or prevention of this condition presents a new range of technical problems both of management and implement design, if the great benefits of lower costs and higher efficiency on the farm as a result of mechanization are not to be lost. The most important approach is prevention. Here the individual farmer can do much by a careful study of his own soil. He must be in a position to recognize conditions of moisture not only on the surface of the soil but at and immediately below the level to which the plough penetrates. Moisture is the determining factor in soil compaction and damage is most often done by an occasional use of machinery following too closely after a wet spell because of the farmer's alarm at the lateness of the season or the growth of weeds in a crop. One of the advantages of mechanized farming is that a large area can be covered quickly, so that the farmer can afford to wait until conditions improve. In some circumstances the duration of critical soil conditions can be reduced by surface and sub-surface drainage to carry away excess water more rapidly. Resistance to puddling can be built up by increasing the soil's organic matter with a grass or meadow crop. The idea of " minimum tillage " is a helpful one, discreetly used. The ground may be ploughed once and most of the preparation of the soil left to nature's methods of soaking and drying or freezing and thawing. In some instances the seed may be planted in the newly-ploughed soil and weeds kept in check by means of sprays before and after their appearance. Cross-dragging, which cultivates the crop and kills the weed with a minimum traffic, may be of assistance. Research on methods of alleviating soil compaction is being carried out in Europe and the United States currently.[1]

* * *

The fact that General Motors are now offering air suspension on cars as an alternative to steel springs indicates that the device has passed from the experimental into the range of the practical, the numbers of cars made in the United States being too great for manufacturers to risk the loss which would result from costly free servicing of an inadequately tested mechanism. It is known that British car manufacturers, too, are actively investigating the possibility of introducing air suspension, which is by no means a mere selling point designed to catch the attention of prospective buyers. It

[1] *Power Engg.*, Mar., 1958.

[1] " Soil Conservation " (U.S. Department of Agriculture), Apr., 1958.

offers distinct advantages over steel spring suspension, which is much too stiff for a light load. Air suspension, free from this drawback, commonly uses compressed air from an engine-driven pump and gives as much riding comfort when the vehicle is empty as when it is fully loaded, since the increase in resistance to load is automatic. Dampers are required as they are for steel springs and in addition some form of linkage to control the lateral location of axles, though this raises no problem. Air springs are at their best on rough surfaces and on smooth ones deal admirably with such obstacles as manhole covers and potholes, at the same time providing better insulation from road noises. Engineers are confident that air suspension could reduce road wear once problems of materials and sealing have been surmounted.

* * *

Attention has recently been called to a notable centenary, steel having been produced for the first time in July, 1858, on an industrial scale in Sweden. The first producer, Göran Fredrik Göransson, used the Bessemer process invented and patented two years earlier, this Anglo-Swedish co-operation leading the world in the technique of mass-produced ingot steel. On July 18 next the centenary of this major development in the history of Swedish steel will be celebrated. Göransson's first experiments were carried out at Edsken, situated some ten miles west of Sandviken and the ingots were conveyed from there to the Högbo forge, shown here in preservation, situated on the outskirts of the community. In 1862, feeling that the right time had come for further expansion of ingot production, using the Bessemer method Göransson founded the Sandvik Steel Works on the grounds still occupied by the main plant of that company. The Swedish Post Office is to commemorate these events by issuing two postage stamps on July 18 and that day a number of personalities—among whom several of Mr. Göransson's descendants—are to be invited to partake in a visit to the historical sites at Edsken and Högbo, where monuments will be unveiled and an account will be given on the extensive historical research work carried out during the last few years on the Edsken experiments.

Original Furnace, near Sandviken.

* * *

America's National Advisory Committee for Aeronautics recently tested by launching a 12-ft. balloon, inflated from a 9-lb. package so as to form a bubble of air. A similar bubble is to be launched later on into an earth-circling orbit from an Explorer satellite. The bubble under test was carried to a height of 50 miles over Wallops Island, Virginia, by a four-stage rocket using solid fuel on April 25. The plastic balloon, thinly coated with aluminum foil and inflated with air to smooth the wrinkles from the surface, was tracked by radar for over an hour before the jet stream drew it away over the ocean. It is proposed to build a larger aluminum-coated bubble some 100 ft. in diameter when inflated, which would easily be visible to the naked eye and useful in the study of the possibilities of satellites in establishing communications stations.[1]

* * *

An American company has developed new equipment to meet the security needs of a West Coast contractor. The System Development Corporation of Santa Monica, California, is concerned with research on air defence systems and 1,200 employees enter and leave the building daily. It is none the less necessary that all scientists and mathematicians working on classified projects should have ready access to papers, maps, and films of a highly secret nature. Much of this classified documentation can now be left conveniently in open racks and in project rooms overnight, the new device which makes this possible being a piece of electronic equipment the

[1] *Science News Letter*, May 10, 1958.

size of a half grapefruit, mounted in the ceiling of the room to be protected from intruders. The device transmits ultrasonic signals which flood the room with sound waves at 19,000 cycles per second. The slightest movement in the room alters the frequency and causes an alarm to sound at the central guard station, where a control panel indicates which room has been invaded so that guards are able to converge on that room. The device is said to be tamper-proof and greatly reduces the number of guards needed to insure full protection.[1]

* * *

A recent report shows that penguins and other seabirds carry very well-developed nasal glands which the land birds do not have. It had been thought that the function of these was to protect the sensitive lining of the nasal cavity from the irritation of salt water. Evidence now suggests that in fact these glands remove excess salt in a very efficient way. Dr. Kurt Schmidt-Nielsen of Duke University and Dr. W. J. L. Sladen of Johns Hopkins University, conducted an experiment with a Humboldt penguin. The bird was given 5 g. of salt embedded in fish. In their report the scientists state that 10 min. after feeding salt nasal secretion began and lasted for over 11 hours. Analysis showed that about two-thirds of the salt had been eliminated nasally in four hours. By contrast, the kidney accounted for "perhaps one-tenth" of the amount of sodium chloride excreted by way of the nasal salt glands. The concentration of salt in the nasal secretion was well above that of sea water, so that the penguin gains drinkable water by the process. This may account for the presence of the special glands.[2]

News Letters

VANCOUVER

June 6.

Company Activities.—Investigation during the past year of the possibility of recovering iron from the black sands at the north end of Graham Island, Q.C.I., has proved disappointing, with the result that the Hon. W. K. Kiernan, Minister of Mines for British Columbia, stated on May 12 that "the black sands of Graham Island are too low in iron-ore content to make production worthwhile." When the reserve was listed on Graham Island in 1957 three companies applied for rights in the 250 sq. mile area. These were Mogul Mines, Ltd., which is understood to have expended some $40,000 in subsequent exploration, the Utah Co., of the Americas, and a subsidiary of the Westport Chemical Co., of Seattle.

Under notice of May 22 Mr. S. W. Taylor, Registrar of Companies for British Columbia, has declared the following companies dissolved and struck from the register pursuant to sub-section 4 of section 208 of the Companies Act :—

Akokli Tungsten Mine, Ltd., Alhambra Copper Co., Ltd., Apex Ventures, Ltd., Argus Consolidated Mines, Ltd., B. D. Petroleum, Ltd., Ben Hur Uranium, Ltd., Big Bend Placers, Ltd., International Metals, Ltd., Can-Amer Mining and Milling Co., Ltd., Gapco Gas and Oil Co., Ltd., Circle Petroleum, Ltd., Climax Mines, Ltd., Columbia Lead and Zinc Mines, Ltd., Delbo Tungsten Mines, Ltd., Dorado Uranium, Ltd., International Lead and Zinc Mines, Ltd., Emerald Oils, Ltd., Flater Exploration, Ltd., Frontier Mines, Ltd., General Mines Corporation, Ltd., Gordon Gas and Oil, Ltd., Great Basin Petroleum, Ltd., Great West Uranium Co., Ltd., International Cement Corporation (1953), Ltd.

Noranda Mines, Ltd., McIntyre Porcupine Mines, Ltd., and Canadian Exploration, Ltd., have formed an equal partnership to develop the big zinc-copper-silver deposit of Mattagami Syndicate in North-Western Quebec. Preliminary work and diamond drilling by the stakers and owners has indicated 14,000,000 tons of ore grading 13·5% zinc and 0·65% copper, with 1·11 oz. of silver and 0·016 oz. of gold per ton. The Mattagami Syndicate is composed of six equal partners including Leitch Gold Mines, Ltd., Highland-Bell, Ltd., Iso Uranium Mines, Ltd., Dome Mines, Ltd., Teck-Hughes Gold Mines, Ltd., and Area Mines, Ltd. An operating company is to be formed with the optionees receiving one-third of the shares on firm commitment to expend at least $400,000 on development.

Skeena.—Silbak Premier Mines and Premier Border Gold Mining came to terms on May 23 when the latter accepted a cash payment of $45,000 for all its equity in the 11 Crown-granted Northern Lights claims, which adjoin and are accessible through the Silbak Premier mine. The transaction gives Silbak clear title to all properties it is proposed to work when production is resumed and at the same time removes Premier Border entirely from mining. Combined ore reserves are now estimated at 149,396 tons, grading 0·18 oz.

[1] *Science News Letter*, May 10, 1958.
[2] *Nature*, April 26, 1958.

of gold and 2·39 oz. of silver per ton, with 3·03% lead and 4·53% zinc. Premier Border is now engaged in oil and gas development in Western Canada and elsewhere in North and Central America.

No work was done during 1957 on the 14 claim group of Morris Summit Gold Mines, near Stewart. The Crown-granted claims are being maintained in good standing through payment of the acreage tax; net cash expenditure in the year ended January 31, 1958, was $1,383. At the end of the year net cash amounted to $19,333. Of the 3,000,000 shares of authorized capital 999,750 shares were issued. The option granted to Newmont Mining Corporation of Canada, Ltd., to purchase 200,000 treasury shares by February 24, 1958, was not exercised. The Granby Consolidated Mining, Smelting, and Power Co., has acquired half of Newmont's interest in the Morris Summit company.

Omineca.—After expenditure of $145,478 in the exploration and development of the Ingenika mine, near Fort Grahame, the Consolidated Mining and Smelting Co. of Canada has notified Ingenika Mines, Ltd., that it is relinquishing its option to obtain control by continuing the work. When Cominco has taken down the shares to which it is entitled for the work done the issued capital of Ingenika will stand at 1,969,211 shares of the authorized capital of 3,000,000 shares.

Cariboo.—Cariboo Gold Quartz Mining has encountered three new limestone-replacement orebodies in the course of its long drive to the Mosquito Creek fault. Two of the bodies had been previously indicated by diamond drilling, but the third appears to be entirely new. April production, obtained with a drastically-reduced labour complement of 150, was valued at $86,500, with a material improvement in grade. April production of the subsidiary, French Mines, Ltd., operator of the French mine at Hedley, was valued at $20,500, with gross operating cost of $14,000.

Kamloops.—Four days after receipt of notification by the American Smelting and Refining Co. that it was relinquishing its option to purchase a majority interest, Bethlehem Copper announced it would commence immediately an underground-development programme as recommended by the company's geological and engineering consultants, James and Buffam, of Toronto. Cessation of work on the Bethlehem property has not affected the programme of American Smelting and Refining on the numerous other properties in the Highland Valley on which the company holds options. Announcement by John Hallberg, vice-president of Minex Development, Ltd., that Asarco is continuing its work on the Minex property has been confirmed and it is understood the same policy holds good with others.

The Noranda Exploration Co. has taken an option to acquire a controlling interest in the 54-claim block consisting of the Star and Bob groups of Torwest Resources, Ltd. The group adjoins the Trojan mine on the south and the Northlodge property on the east. Torwest has retained the 50-claim Raha group adjoining the new Noranda acquisition on the south. Under the agreement Noranda will form a new company of 5,000,000 shares, with Torwest receiving a vendor's interest of 1,250,000 shares. Noranda is to take down shares at $1·00 each to provide working capital and also holds an option to purchase 250,000 shares of Torwest's equity at $1·00 per share. Torwest has a small exploratory crew at work under the direction of an engineer on the Raha group. An important holding of Torwest is a solid group of 11 claims and three fractions south of the Craigmont property on which large-scale drilling is now being done. The Torwest ground projects into the heart of a large parcel of claims held by Noranda.

Revelstoke.—New York-Alaska Gold Dredging Corporation, which holds a one-third interest in the River Jordan lead-zinc prospect in partnership with American Standard Mines, Ltd., states in its annual report for 1957 that an option has been granted the Bunker Hill and Sullivan Mining and Concentrating Co. to obtain control by carrying on the development of the property. Bunker Hill has been given the 1958 season for examination and checking of previous work. If it then elects to exercise its option Bunker Hill will be required to expend not less than $500,000 in further development within five years. In the event of production the Bunker Hill company will be entitled to the return of its pre-production expense, after which operating profit will be divided 65% to Bunker Hill and 35% to the vendor companies. New York-Alaska has recently taken a participation with the M. J. Boylen interests of Toronto in the Beauce Placer Mining Co. in the development and operation of placer-gold deposits in the Chaudiere Valley of Quebec.

Trail Creek.—Mid-West Copper and Uranium Mines has resumed operation of the Velvet mine near Rossland. An immediate attempt is to be made to learn the extent of an occurrence in which a diamond-drill core length of 24 ft. assayed 3·2% copper and special attention will be given to those sections of the mine in which gold is the predominant metal. During the brief operating period of 1957 production was valued at $116,493 and consisted of 1,000 oz. of gold, 1,410 oz. of silver, and 238,863 lb. of copper.

Lardeau.—Sunshine Lardeau Mines produced 849 tons of lead concentrate and 1,009 tons of zinc concentrate in the quarter ended April 30 from its mine at Camborne, milling 7,520 tons of ore. Net smelter returns have been estimated at $171,117 with profit, before write offs, of $34,539. No development work was performed during the period and all ore in the No. 4 and Eclipse veins has been broken. The company president, Mr. J. A. Pike, has since advised that milling was suspended on May 16, at which date all available ore had been treated. Options have been arranged with Lardeau Mines Exploration, owners of an adjoining group of claims, and with Mr. D. A. McIntosh, owner of the Lead Star group, about four miles to the west. It is planned to explore each geologically and, if warranted, to follow with diamond drilling. Work has commenced on the former.

Golden.—Giant Mascot Mines has undertaken to supply 1,500 tons of barite monthly to McPhail Engineering Co., of Tacoma, Washington, commencing July 1, 1958. Within six months the shipments are to be increased to 3,000 tons monthly until the initial order for 100,000 tons is fulfilled. The Giant Mascot tailing pond, resulting from the lead-mining operation at Spillimacheen, is estimated to contain a minimum of 250,000 tons of barite of the required grade Capital outlay for additional mill installations is estimated at $15,000. Profit on production of barite is estimated in excess of $2 per ton.

TORONTO

June 15.

Gold Production.—The output of the gold mines of Ontario for March included 229,361 oz. of gold and 38,323 oz. of silver, valued at $7,873,264, from 807,458 tons of ore milled. For the first three months of the present year 2,313,756 tons of ore containing 659,509 oz. of gold and 105,255 oz. of silver and having a total value of $22,584,195 was treated. For the same period last year the mines milled 2,255,991 tons of ore having a content of 623,459 oz. of gold and 101,068 oz. of silver, the total value of which amounted to $20,999,964.

In April 785,264 tons crushed yielded 228,590 oz. of gold and 35,712 oz. of silver, worth $7,789,644.

Porcupine.—Dome Mines reports a profit of $1,804,337 for 1957, as compared with $1,937,447 for the previous year. In 1957 the company received Emergency Gold Mining Assistance equal to $2·85 per oz. of gold produced.

Kirkland Lake.—At Upper Canada Mines the shaft is being deepened to provide five to six new levels and bring the No. 1 shaft to a depth of 4,600 ft. Most of the ore milled during the past year was drawn from this area, where depth development has been favourable. Upper Canada has purchased 300 acres to 400 acres east of the mine from Scott Chibougamau Mines to protect the down-dip projections of the ore occurrences. Cost was $10,000 and Scott Chibougamau is to receive a royalty of 25 cents per ton on any ore from the ground that grades better than $10 per ton.

At Kerr-Addison Gold Mines the bullion output last year amounted to $17,474,450 from the milling of 1,652,132 tons of ore, as compared with $16,277,717 from 1,665,045 tons in 1956. The net profit was $4,589,907. The average gold price in 1957 was $33·65, down from $34·40 received the previous year. The company president, Mr. James Y. Murdoch, reports that 45% of the total production of 453,229 oz. of gold bullion was sold in the open market, against 42% the year before.

Sudbury.—The interim report of the International Nickel Co. of Canada, Ltd., and its subsidiaries for the three months ended March 31, 1958, shows net earnings in terms of United States currency of $12,213,000 after all charges, depreciation, depletion, taxes, etc., equivalent to 83 cents per common share. In the three months ended December 31, 1957, net earnings were $20,124,000, or $1·38 per common share and in the first quarter of 1957 net earnings were $23,504,000, or $1·61 a common share. It is stated that " deliveries of nickel in all forms for the first quarter were approximately 50,000,000 lb., compared with over 75,000,000 lb. for the

fourth quarter of last year. The continuing lower level of demand and the size of stocks of unsold nickel have required the company to make two successive curtailments of nickel production in Canada, reducing the annual rate of production as from May to approximately 250,000,000 lb."

Falconbridge Nickel Mines has announced that it expects its current contracts will enable it to meet the present situation without "undue impact in operating schedules."

Elliot Lake.—The Ontario Minister of Mines has announced the establishment of a special committee to investigate mining systems employed in the uranium areas of Elliot Lake, particularly in relation to methods of rock support. He stated the investigation is the result of accidents occurring recently in mines in the area. Members of the committee are Prof. R. G. K. Morrison, of McGill University, Prov. A. V. Corlett, of Queens University, and Prof. R. H. Rice, of the University of Toronto.

Saskatchewan.—Rix-Athabasca Uranium Mines reports that while its revenue rose from $948,958 in 1956 to $1,217,740 in 1957 net revenue was down from $442,798 to $385,909 owing to increased development expenditure. After charging $211,534 for depreciation and $460,679 for preproduction development the net loss for the year was $273,410. The report says that the contract with Eldorado for the shipment of 600,000 lb. of U_3O_8 was completed last December. A temporary contract for a further 77,000 lb. has been signed at a less favourable price and will be completed in the first half of this year. A custom milling contract is being negotiated with Lorado Uranium Mines. During 1957 43,325 tons of ore were shipped to Eldorado the grade averaging 4·75 lb. U_3O_8 to the ton. Ore reserves in the Smitty zone are estimated at 37,638 tons grading 4·8 lb., a decrease of 4,000 tons during the year although 28,000 tons of new ore were added. In the Leonard workings, now closed down, there is 18,000 tons probable with a further 50,000 tons of possible ore.

The output of uranium ore from the Pat mine of National Explorations, in the Beaverlodge area, during the first three months of 1958 was valued at $142,000, the company reports. Shipments are averaging about 1,500 tons of ore monthly.

New Brunswick.—Heath Steele Mines, Ltd., which has been milling about 1,200 tons of ore daily from two open-pits in the Bathurst area has suspended operations; the company was shipping copper concentrates to the American Metals smelter at Cataret, New Jersey. Lead and zinc production was largely in the experimental stage, with some going to world markets.

The Provincial Department of Mines reports that at the end of December there were only 34,078 claims in good standing, as compared with 51,574 in June of last year.

The closure of Heath Steele follows the suspension of the Brunswick Mining and Smelting Corporation, Ltd. It had been announced earlier that funds were being sought for a 2,000-ton concentrator and lead smelter for the Bathurst area, expected to cost $30,000,000 and taking two to three years to build. The Corporation possesses reserves of an overall grade calculated at 6·6% zinc, 2·4% lead, 0·5% copper, and 2·1 oz. silver. The ore-body width ranges to 200 ft. and ore continuity is indicated below the shaft depth. Only one company is still operating in the area, Nigadoo Mines, Ltd., which is currently putting 50 tons to 150 tons daily through a pilot mill. No decision to go into production has yet been made.

Manitoba.—The report of Sherritt Gordon Mines for 1957 shows a profit of $5,476,000, the revenue from metals and other products being $20,658,005. Production at Lynn Lake, with 1956 figures in brackets, was: Nickel, 20,067,367 lb. (19,239,648); returnable copper in concentrates, 9,495,989 lb. (9,006,188); cobalt, 172,053 lb. (107,414). In addition to the company's own production nickel produced on a toll basis for custom shippers totalled 2,419,780 lb. compared with 152,866 lb. in 1956. The report says that one new ore-body was located during the year together with extensions to known ore-bodies which resulted in an increase of ore reserves of 570,000 tons. Sinking continued at the Farley shaft and a depth of 1,862 ft. was reached, with stations cut at 150-ft. intervals. This shaft will be completed at about 2,350 ft. during 1958 and development work on the 2,000-ft. level will commence. An extension of the mill capacity at Lynn Lake is to be started this year and completed some time in 1959.

Quebec.—Gold shipments from the mines of Quebec in January totalled 85,836 oz., as compared with 80,659 for January, 1957, and 85,868 oz. for December last. Corresponding silver figures are 303,527 oz., 308,728 oz., and 322,622 oz. The January asbestos output was 53,517 tons.

Noranda Mines reports a profit of

$11,931,956 for 1957, metal sales totalling $29,055,038. In the year 3,662 tons of ore was hoisted per day at the Horne mine. Operations at Noranda were normal but smelter production increased sharply in the last quarter largely owing to receipt of copper concentrate from Geco Mines, in which Noranda and associated companies hold a 36% interest.

MELBOURNE

June 20.

South Australia.—The decision of Broken Hill Proprietary to erect a steel plant in South Australia has changed the State Government's plans in regard to mineral exploration. These had been directed toward the proving of sufficient iron ore in the Middleback Ranges to permit the establishment of a State steel industry. A 10-year programme of search in the Middleback region has now ended and work is to be carried out in the Cowell district to determine the significance of a number of anomalies located in geophysical surveys in country devoid of rock exposures by drilling. The intensive survey for iron-ore deposits was commenced in 1947, since when 64,000 ft. of drilling has been completed by which about 30,000,000 tons of high-grade iron ore has been located adjacent to leases held and worked by the Broken Hill Proprietary Co. This discovery has been important in Government negotiations, which have led to the decision by the company to manufacture steel in the State. The ultimate future of the industry will rest with the low-grade deposits in the Middleback Ranges which are considered to contain several thousand million tons of material, upon which test work by the B.H.P. Company has been in progress for some time. Government activity in prospecting for mineral deposits and so opening the way to their operation by private enterprise is thought commendable and should be carried out on a greater scale throughout the Commonwealth.

Northern Territory.—Mineral possibilities of the Northern Territory are improving, figures released for the 1956-57 period showing that the value of the mineral output was £A5,794,000. Copper and gold, mainly from the Tennant Creek field, were the principal minerals produced, with the exception of the uranium from the Rum Jungle occurrence. There 541,652 lb. of uranium oxide valued at £A2,000,000 was produced; output from the South Alligator field was valued at £A475,000. In 1946 the value of the mineral products of the Territory was only £A166,000.

Other minerals produced in the period now under review were mica, manganese, tin, wolfram, and silver-lead. The fall in the price of wolfram has severely affected that industry, which was attaining some importance. Potentialities of mica mining are much more important than the scale of production indicates. At Maranboy extensive prospecting is being done by three companies working in conjunction, but prospects of underground operations are as yet indefinite. A new discovery has been made at Mount Harris, east of Adelaide River, which is reported to be rich and is already producing in a small way. On the MacArthur River extensive deposits of silver-lead ore are being prospected by Mount Isa Mines and are believed to be of considerable promise. Manganese is being worked at Renner Springs, north of Tennant Creek, but transport is a heavy handicap on such an ore. Prospecting for uranium is very quiet. Tennant Creek is the centre of greatest activity, mainly for gold. For some time there was considerable drilling, following the successful development of the Peko Copper mine, which is the Territory's important producer, but the search for other copper deposits has been unsuccessful so far.

Copper.—There is fairly general satisfaction over the decision of the Commonwealth Government to assist the copper-mining industry. Hitherto, the Australian price for copper has been £A330 per ton; because of the fall in the world price to much below this figure, the issue was somewhat complicated by the need to protect the users and manufacturers of the metal so that they would not be penalized by the Australian price that would benefit producers but make impossible competition with overseas manufacturers who could buy metal at much less than the Australian price. The position has been met in this way :—

The Australian selling price on the local market will be £A330 per ton and a bounty will be paid on locally-produced copper sold on the Australian market; a tariff will be imposed increasing by £1 per ton on imported copper for each £1 by which the imported price falls below £A275 per ton. The bounty

Aerial View of the Mount Lyell Open-Cast.

will be £A45 per ton to meet the difference between a local landed duty paid price of £A285 per ton and the fixed price to the producer of £A330 per ton. The bounty to the producer will be diminished by £A1 for each £A1 by which the local buying price exceeds £A285.

Mount Morgan and Mount Lyell will both benefit under the scheme. As there is a profit limitation influencing qualification for the bounty Mount Isa Mines will be ineligible. Mount Morgan considers that a positive method has been evolved for assisting the industry and profitable continuance of the company's operations will be assured. It is hoped that the expected report by the Tariff Board on the Sulphuric Acid Bounty Act will assist in increasing sales of pyrite, to the company's further benefit.

There was doubt as to whether Peko Mines, N.L., would be eligible for the bounty, but it is now reported that the company will qualify for payment to an extent somewhat less than the proposed maximum bounty payment. In view of Mount Isa's large expansion programme and the fact that the company has become the largest copper producer in Australia, it is thought in some quarters that the position is rather unfair to this great organization, but, broadly, the industry has been safeguarded, as well as the interests of the manufacturing side of the community.

Lake View and Star.—This company's development work in the period between December 25 and March 18 indicates a very satisfactory underground position and a high proportion of payable ore in the total footage on lode. In the eastern group of lodes driving on lode channels totalled 5,496 ft., of which 62·4%was in ore averaging 5·7 dwt. gold per ton. In the western group of lodes, driving on lode channels totalled 2,287 ft., of which 60·4% was in ore with an average value of 5·4 dwt. gold per ton. Average width of the ore-bodies in the eastern group was 58 in. and in the western group 57 in. These percentages of payable ore and the average width of the lodes are very satisfactory and are a good pointer to the future of the mine.

Uranium.—Measured against the optimism of the early search for uranium the results must be considered as disappointing. Although the occurrence of uranium minerals in Australia was widespread in the northern part

of the continent commercial deposits have been disproportionately small. The history of the uranium boom has been no different from booms in other minerals and metals; a few workable mines emerge from many prospects. Australia's commercial uranium deposits are Rum Jungle (producing) and United Uranium (moving toward production) in the Northern Territory, Radium Hill (producing) in South Australia, and Mary Kathleen (just commencing production) in North Queensland. Actually, about £A30,000,000 has been invested in uranium. Rum Jungle in 1956-57 produced uranium oxide to the value of about £A2,000,000 and the South Alligator field raised ore to the value of £A475,000, estimated. Production by Radium Hill, South Australia, is reported as worth £A7,500,000. Other hoped-for big discoveries of uranium ore have not eventuated and prospecting has fallen to a very low level. United Uranium has ore reserves equivalent to five years from January, 1959, when treatment is expected to commence. At present negotiations are in progress with the U.K. Atomic Energy Authority regarding the contract for the purchase of the company's product. It is expected that eventually the company will have a plant capable of treating expected additional ore on a low cost basis. At the same time it is intended to renew activity in prospecting for other occurrences.

Commencement of treatment at the Mary Kathleen uranium plant is a matter of considerable interest at the moment. The whole plant has been completed nine months ahead of schedule, which is a notable achievement in North Queensland environment and conditions. Work on ore treatment has been commenced, but it will be some time before uranium oxide is finally produced. The power station has been running for several months and the sulphuric acid plant commenced operation a few days before the first ore was put through the treatment plant. In regard to construction the whole work, from site preparation, erection of township of 221 houses, the dam of 3,000,000,000 gal. capacity, and all plant units, was carried out in 27 months, during which time the open-cut mine was opened up and prepared for production.

Morning Star.—Once the Morning Star mine was a prominent Victorian gold producer, but despite hopeful indications from diamond-drilling below the 1,900-ft. horizon results were disappointing and the outlook gloomy. The auriferous reefs occur, almost flat, in a basic dyke and low-grade to barren zones have been part of the mine's history in a life of nearly 100 years. However, recent cross-cutting at the No. 20 level has cut a high-grade reef at 163 ft. from the shaft at a point 150 ft. south of a diamond-drill intersection which gave a value of 12·6 dwt. gold over a width of 38 in. On No. 21 level drilling has cut a reef showing fine gold in the core at 130 ft. down-dip from the intersection in the cross-cut. It is possible, therefore, that the mine may be restored to a profitable basis and help to revive the gold-mining industry of the State which is very depressed.

Central Norseman.—The Central Norseman Gold Corporation continues to hold its leading position amongst Western Australian gold mines. In the year ended March 31 last the company milled 172,195 tons of ore and recovered 95,722 oz. of gold, an average recovery of 11·12 dwt. per ton; in the previous year the mill throughput was 162,715 tons and the gold recovery 94,368 oz. The forthcoming dividend payment will total £A422,500 and will bring the total of dividends paid to £A3,347,500. Underground developments have been consistently good, both in the Phoenix mine and in the neighbouring Princess Royal mine. Development work in the Phoenix mine of late appears to have been confined to the more recently discovered Crown reef and work has consistently opened up high-grade ore. In comparison with the Kalgoorlie mines ore reserves are not so far ahead of mill requirements, but development work has been very consistent in opening up good to high-grade ore in both sections of the property.

Gold Mines of Kalgoorlie.—The latest move by this mining organization, which in recent years has absorbed the Paringa, Boulder Perseverance, South Kalgurli, and Enterprise mines, is the acquisition in the treatment plant of Kalgurli Ore Treatment Co. of the interest previously held by North Kalgurli (1912), Ltd. This latter company now has its own treatment plant, previously known as the Croesus Proprietary. The purchase price of the interest is not known.

Iron Ore in Tasmania.—The Tasmanian Government has been looking to the possibility of establishing an iron and steel industry in that State. There are several iron-ore deposits in the island, but all are not of high grade and, collectively, the possible tonnage was not large. The most important occurrence appeared to be that on the Savage River in the north-west of the

State and this was selected for further test by geophysical work and diamond drilling. This work has shown previously unindicated extensions of the ore-body and progress of the drilling is reported to have given hope that some 100,000,000 tons of ore may ultimately be proved. The extension of the known ore-body has a width stated to approximate 300 ft. and a vertical depth of 500 ft. has been reached. Assays of the drill cores gave an average grade of 46% iron, so that the grade would have to be raised to a satisfactory figure for smelting. Some titanium is reported to be present, but other serious impurities seem to be absent. Information available suggests that metallurgical test work will be an important phase before the commercial value of the deposit can be accurately assessed.

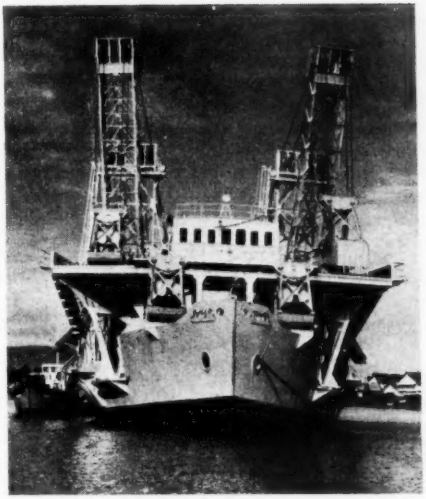
West Australian Petroleum.—This company continues active prospecting for oil in Western Australia, despite a long series of disappointments. Operations have moved from the original and well-tried Exmouth Gulf country to the Kimberley district and to the south-east of it. After much exploratory work the Canning Basin has been selected and a bore has been completed at a locality known as Samphire Marsh. The drilling plant is now being moved to a new locality at Meda. It has been decided to concentrate on the refraction seismograph survey method rather than on the reflection method, as the technique has proved very successful in recent months in covering rapidly extensive areas and obtaining reliable information. With the approved technique a crew now covers seven miles a day in comparison with one mile per day with the previous method.

Queensland Bauxite.—The extent of this deposit is being gradually proved by the Consolidated Zinc's subsidiary (Commonwealth Aluminium Corporation Pty., Ltd.) and it is reported that greater reserves have been indicated than had been expected. So far work has shown that deposits of commercial value extend over an area of 160 sq. miles.

FEDERATION OF MALAYA

June 7.

Chamber of Mines.—Speaking at the annual general meeting of the F.M.S. Chamber of Mines held in Ipoh the new president, Mr. K. J. Cumming, said that the disturbing feature of the current situation from the producers' point of view was the lack of demand in America, even if the growing exports of tin from Russia and its satellites, notably Poland, to Western Europe had exacerbated the position. In his view, however, long-term prospects were "by no means unfavourable." Mr. Cumming spoke also of the need of a favourable climate for re-investment and of a more liberal land policy. The mining industry was suffering from land starvation, he said, and its efforts to find new tin-bearing areas to replace the rapidly dwindling ones held under mining lease were being hamstrung by a land policy which could only be described as totally unrealistic. He believed that Malaya still had considerable hidden reserves of tin, but they could only be discovered by intensive prospecting. The present policy, under which large tracts of country were virtually closed to mining, or even prospecting, was short-sighted. At April 30 last there were 14 dredges closed down not because of tin restriction but because of the exhaustion of their ore reserves. The position was therefore serious, particularly as many more mines were rapidly running out of land. The formation of the National Land Council in January had been a step in the right direction, but time was running out and it was most essential that every effort be made by the council to formulate a sound and realistic land alienation policy at the very earliest.



Open-Sea Dredge in Siam.

New Projects.—It has been reported that the Kuala Selangor area of Malaya is to be developed for tin by two leading companies. An investment of $30,000,000 (Malayan) in the region has been mentioned. The swampy jungles around Batang Berjuntai contain considerable quantities of tin and one firm has brought a special dredge from California to work there. This is 75% completed. These moves follow the crushing of the Communist terrorists who once infested the jungles in the state of Selangor. Individual miners are applying for land for mining purposes.

Thailand and the Tin Agreement.—According to recent reports tin producers in Thailand have been pressing the Government to withdraw from the International Tin Agreement. This arises, it is stated, out of dissatisfaction about the allocation allowed by the Tin Council in London. The Council decided to keep world exports of tin for the July–September period at 23,000 tons, but to increase Thailand's quota percentage of this total from 7·35% to 8·35%. Producers in Thailand, however, are pressing for 10%.

Accident at Gold Mine.—Following an accident at the Raub Australian Gold Mine work has been going ahead on draining water out of flooded tunnels. Engineers from the army and navy have been helping to get rid of the water which, it is understood, gushed from a disused section of the mine into a tunnel 600 ft. below the surface when some blasting operations were going on, 12 men losing their lives. Later mining operations were continued in areas that had not been affected.

Under-Water Oil Pipeline.—Standard-Vacuum Oil has laid a submarine pipeline for its new oil storage centre in Malacca. A section of this 10-in. pipeline runs for 2,800 ft. under the sea; another 5,000 ft. is buried 4 ft. down under the shore at Tanjong Kling. The Royal Navy boom vessel *Baronia*, under charter to the company, helped to lay the pipeline. It was the first operation of its kind carried out by an oil company in Malaya.

Sarawak.—Mr. J. H. Harris, chief research officer of the Department of Mines, Federation of Malaya, has gone to Kuching to study ways of assisting the gold-mining industry in the Bau district of the First Division of Sarawak, Borneo. He had arranged to visit the Bau mines and to examine the processes used for extracting the gold and ore containing the gold.

Iron Ore.—The first post-war shipment of iron ore to Japan from a re-opened mine at Bukit Langkap, Endau, Johore State, has had to be postponed, according to a report from Johore Bahru. A big stockpile of ore, which had been built up over the last year, subsided, damaging the wharf beside the Endau River at the mine, which is operated by Endau Iron Mining Co., Ltd.

JOHANNESBURG

June 26.

Mining Progress.—In the current issue of the *Journal* of the South African Institute of Mining and Metallurgy Mr. D. M. Jamieson points out that local practice has established the principle that two relatively-small development ends can be driven faster than a single end of equivalent capacity. The reasons for this lie in the use of one of the twin drives or haulages for ventilation, in faster cleaning or lashing or mucking through the use of mechanical loaders, and the better ground support derived from the smaller excavations in the twin-end system. The past decade has seen a marked advance in the rate of driving ends. Advances of 600 ft. a month are now normal in a single end employing two drilling-cleaning crews and one equipping crew in eight-hour shifts. Improved training of all the personnel employed could, in the writer's opinion, step up this rate of advance to the 900-ft. mark with the same equipment. Equipment that has become standard in these development operations include tungsten-carbide chisel-bits, the light jackhammer-type percussion drill used with an air-leg, mobile drilling platforms, the adoption of the 32–38-hole drag round and (not mentioned by the writer but which are locally popular, especially in certain Free State mines) the use of " spot-coolers " or mobile refrigeration units. Other techniques mentioned by the author are the use of roof-bolting especially in slip-faulted or weak hanging ground and, what has more recently become almost universal practice, the adoption of the twin-end or twin-drive or haulage system. The latter facilitates the use of one of the twin system as the return airway, which renders possible multi-cycle operations and therefore a faster rate of advance, probably at a lower cost per foot driven.

South African Affairs.—South African exporters of all goods and commodities,

Flotation Cells at Rustenburg Platinum.

including coal, asbestos, manganese ore, chromite, and other mined or derived products stand to benefit from the recently-established Credit Guarantee Insurance Corporation, formed with Government support and financial backing. Founded under the provisions of the Export Credit Re-insurance Act of 1957 the Corporation protects exporters to the extent of up to 85% of total losses incurred through failures at the importers' end under comprehensive policies. The scheme undoubtedly is an incentive in competitive conditions.

Commenting on tendencies towards extravagant claims for higher wages and salaries with reference to internal inflation, production, and the balance of payments, the Minister of Finance has said that the policy would be maintained of not placing any restraints on overseas investment in the country or on the free repatriation of earnings and capital, but indicated favour for what he described as " ideal overseas investment "—namely, that which became completely domiciled and adopted the Union as their own country. The Minister affirmed his belief that the present imbalance in the country's finances is temporary, resulting from overspending relative to income.

The salary and wage increases recently granted the staff of the South African Railways involves additional costs amounting in the aggregate to about £5,800,000. This and other factors would result in a very considerable deficit. Accordingly all railway tariffs have been raised by 5% to 14% with effect from July 1, 1958.

Dillon, Read, and Co., of the United States, have established, subject to approval by the U.S. Security and Exchange Commission, what has been provisionally named the American–South African Investment Trust, Ltd. This is to invest in gold and industrial shares of companies operating in Southern Africa, mainly in the Union. The trust, which will have an initial capital of $30,000,000, will also deal in gold bullion. A public issue of its shares in the United States is expected to be made in the immediate future. Secretaries and managers to the trust will be Engelhard Industries of Southern Africa, Ltd. Already appointed to the board are Mr. C. W. Engelhard, as chairman, Mr. C. S. Barlow, and Mr. C. F. Todd, as directors, while in its completed organization the board will have a majority of United States directors. Shares are to be purchased mainly from sponsoring houses rather than through the Stock Exchange and negotiations with mining finance and mining share-holding companies to that end have been conducted. Already the General Mining and Finance Corporation has granted the trust options over substantial holdings of mining and industrial shares.

Transvaal.—Stilfontein Gold Mining, which milled 112,000 tons in May, will over the next four years build up the rate towards the

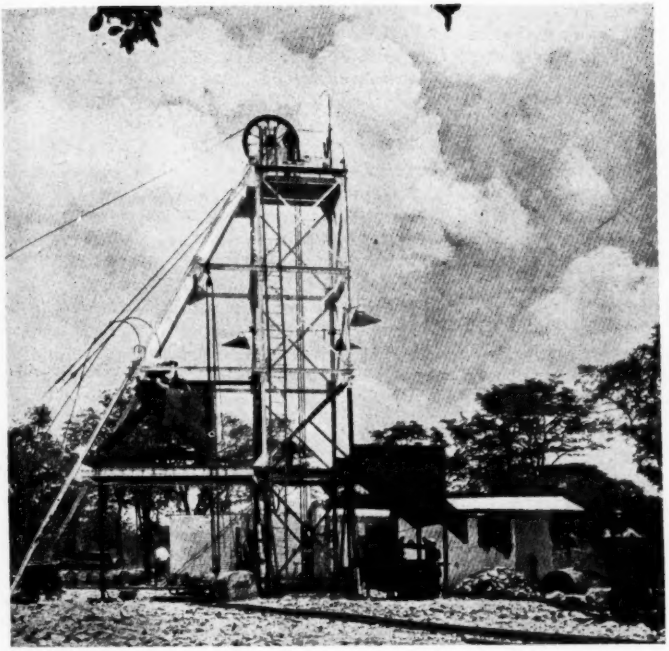
target of 150,000 tons. The programme involves extending the gold plant, installation of a Koepe winder, additional housing, and sinking a new shaft to open up the eastern section, where conditions may be more faulted than those in existing workings and values, at least in sections, tend lower. The new 20-ft. diameter shaft is to be sunk to a depth of 4,500 ft. Capital expenditure will be about £3,000,000 this year, about £2,000,000 in 1959, and about £1,000,000 in 1960. The company is expected to become liable for first tax and lease payments in 1959; this will be partly offset by post-production capital expenditure amortization allowances. Under the revised uranium production the mine's plant allotment will be 386 tons of uranium oxide a year, of which 173 tons will be for the company's own account, the balance being for the accounts of mines associated in the joint project.

The option and prospecting contract held by African Metals Corporation, Ltd., over the base-metal claims of Northern Transvaal (Messina) Copper Exploration in the Pietersburg area is to be terminated by the former on July 31 next. Exploration in the claims under the contract has disclosed fairly widespread copper mineralization with, however, low average values in relation to present copper prices. The "Northern Copper" company will receive all records of the results of the exploration and, if such a course appears advisable, will consider the possibility of further investigation. However, its cash resources are exhausted and the company is therefore unable at this juncture to undertake further exploratory work.

Interest is being shown in both the break-up values of the older Rand mines (which in many cases have extensive freehold interests adjoining the urban areas of the Rand) and the continuation of operations as long as possible in the hope that a higher gold price will improve conditions of operations and profitabilities. This was shown recently in the offer by the Planned Investment Trust, Ltd. (which has an issued capital of £25,277 10s.), to acquire the issued shares of the Unit Securities Group of companies. The latter comprise Affiliated Investments, Drakensberg Investments, Huguenot Investments, Managed Investments, Nassau Investment Corporation, Second Managed Investments, Second Nassau, and Tugela Investments. A large proportion of the investments of these companies are in gold-mining companies, including most of the older mines. In exchange for shares in these companies Planned Investment offered loan notes. The offer was not accepted by the boards concerned, who recommended rejection by shareholders as well. It was accordingly withdrawn and another may be made. The face value of the notes was £13,145,000, not in any way secured or guaranteed. The equity of the shares which were to be acquired was estimated at about £10,500,000 at the time of the rejection of the offer. More recently proposals for voluntary liquidation submitted to the annual general meeting of Modderfontein B Gold Mines, Ltd., failed to secure approval. Opposition to the proposals came mainly from the Modder B Shareholders' Association, which had offered 3s. 9d. a share for at least 60% of the issued capital providing the proposals were defeated. This offer has not yet been implemented. The book value of the assets, which include 8,875 acres of freehold, is £35,000. A reliable estimate of the value of the freehold could not be given, partly because part is subject to mining titles held by two neighbouring mines and partly because of uncertainties over racial zoning under the Group Areas Act. The board has already accepted an offer of £165,000 for machinery, stores, and materials. Estimates submitted or mentioned at the meeting for evaluating the value of the freehold ranged from £100 to £1,000 per acre, depending on the use to which the ground is put.

Work in progress in the deeper levels of East Rand Proprietary Mines, Ltd., has entered the phase at which it constitutes the opening-up of an ultra-deep mine. Initial operations are now proceeding at a depth of 11,000 ft. Further extensions at depth will necessitate the provision of additional shaft systems, adequate ventilation, including cooling or refrigeration plants, and provision against problems of pressure at these great mining depths. Difficulties in implementing the programme lie in providing the required capital and, with travelling times to the working faces getting longer and reducing the effective shift cycles, in holding costs in check.

Orange Free State.—Under prevailing conditions Loraine Gold Mines finds it impossible to achieve a profitable basis of operations. It has therefore been decided to write off the equivalent of £6,581,000 from the existing issued capital through a reduction in the nominal value and a simultaneous consolidation of the shares, resulting in an issued capital of 3,290,674 shares of 10s. each.



Empress Nickel Shaft, Rhodesia.

The Loraine company will then absorb Riebeeck Gold Mining, which has an issued capital of 7,000,000 shares of 10s. each, the effect of which will be to raise the issued capital of the Loraine company in its new form to 10,290,674 shares of 10s. each. The company will then pass to the control of the Anglo-Transvaal group and its board reconstituted. The new lease area will be 7,585 claims and the company will also hold mineral rights over an additional 3,881 claims. The advantages to the Riebeeck company will be immediate use of two completed operating shafts, the surface and underground equipment, installations and housing of the old Loraine company, extensive development, and facilities for the immediate development of the northern Riebeeck section. Furthermore the new company will have payable ore reserves developed, which at September 30, 1957, amounted to 1,043,500 tons averaging 4·2 dwt. gold and 0·28 lb. per ton of U_3O_8 over 44·48 inches. The main disadvantage is that the mill grade of the combined lease area will probably be somewhat reduced from that of the Riebeeck section. However, this will be mitigated or ameliorated for the immediate future by confining mining operations on a reduced scale to the southern Loraine section, which is of a relatively higher grade than the northern, and by initiating development immediately and drawing ore as soon as possible from the northern higher-grade Riebeeck section. The disadvantage of a lower overall gold grade will be more than counterbalanced by uranium revenue, which in the first quarter amounted to estimated working profits of £91,000 from 162,329 tons treated. Nothing has been stated contrary to the continuation of uranium production.

The programme of unwatering the Merriespruit mine provides for the start of pumping towards the end of 1959, if no undue delays arising from water-bearing fissures are experienced. The company remains entitled to its uranium oxide output quota on the resumption of production.

Virginia O.F.S. Gold Mining has reported that over the first five months of 1958 30,000 ft. of reef sampled averaged 36·3% payable, the average of the payable footage being 321 in.-dwt. and 27·25 in.-lb. of uranium oxide ; this reflects a substantial increase in footage on the 1957 figures. It is possible that an increased footage on the Leader and/or Leader-Basal horizons is now being advanced.

Free State Gold Areas, Ltd., has applied

for an interdict against certain mining companies in the vicinity, restraining them from continuing to pump underground water into a pan, which would in time be converted into a lake containing about 20,000,000,000 gallons of water and would cover part of the ground the mineral rights of which are held by the company. The company contends that this water could easily render impossible the future exploitation of those rights. The defending companies are Virginia and Merriespruit, while the mines at present discharging underground water into the pan are Virginia, Presidents Brand and Steyn, Free State Geduld, Welkom, and Western Holdings. Tests involving the use of suitable tracers have shown that underground water pumped to surface does seep back into the mine workings.

Swaziland Protectorate.—The Geological Survey Department reports a mineral output for 1957 valued at £2,462,816. Only one shipment of diaspore was effected during the year, due to protracted negotiations with the West German buyer. These negotiations have now been completed, providing for a monthly export quantity of 500 tons. The diaspore is sorted from mined diaspore-pyrophyllite-andalusite ore, the pyrophyllite being sold on the local market. Under the direction of a large mining house which has secured an option on the property, Swaziland Barytes, Ltd., is conducting a programme of exploratory development to determine the ore reserves in the vicinity of the mill and the "pinch-and-swell" characteristics of the barytes. Exercising of the option and a programme of expanded production depend on the results of the exploratory development.

Tin output is being conducted in virgin areas of old workings and unless new areas are discovered production is bound to decline. Gold production from the Devil's Reef mine has virtually ended, future gold production depending on prospecting operations by a mining house which has taken up options over 3½ sq. miles and secured prospecting rights over a further 2 sq. miles. Gold prospecting includes the investigation of a promising proposition and the systematic resampling of the Ivanhoe mine, worked in the early 1900's.

Coal exploration again attracted most attention during 1957, the outstanding discovery of the year being the disclosure in two mineral areas in the Stegi district of Coal Measures tentatively correlated as Upper Ecca. The features of the Upper Ecca series are summarized as: Average thickness of 435 ft.; four seams, the main one being about 30 ft. thick containing about 20½ ft. of coal, the others exceeding 3 ft.; anthracitic, average analysis being 12·7 lb./lb.; ash 18·9% (on the high side), volatile matter 5·9%, and fixed carbon 74·3%. In the limited area drilled reserves of about 35,000,000 tons were indicated.

In association with Guest, Keen, and Nettlefolds, Ltd., the Anglo American Corporation of South Africa has formed the Swaziland Iron Ore Development Co., Ltd., in which it holds the controlling interest. The company has an exclusive prospecting licence over the iron-ore deposit at Bomvu Ridge, near Mbabane, and is conducting a geological and metallurgical investigation of the deposit with a view to exploitation.

Natal.—Umgababa Minerals, Ltd. (in the Anglo American group), is to commission its £1,500,000 concentrating plant, about 24 miles south of Durban, in July. Batteries of Humphreys spirals will produce a concentrate of ilmenite, rutile, and zircon, which will be separated by electromagnetic and electrostatic separators. The company has contracted to supply the ilmenite to a titanium paint and products factory jointly operated by the African Explosives and British Titan companies. The raw beach sands will be removed from site by rotary excavators feeding mobile "stackers" that in turn feed the conveyor system discharging into the plant's surge bins. The sands will be pulped with sea-water for treatment in the spirals, the concentrates from which will be washed by fresh water and then differentially separated. Output capacity of the plant will be 100,000 tons of ilmenite, 10,000 tons of zircon, and 7,000 tons of rutile a year.

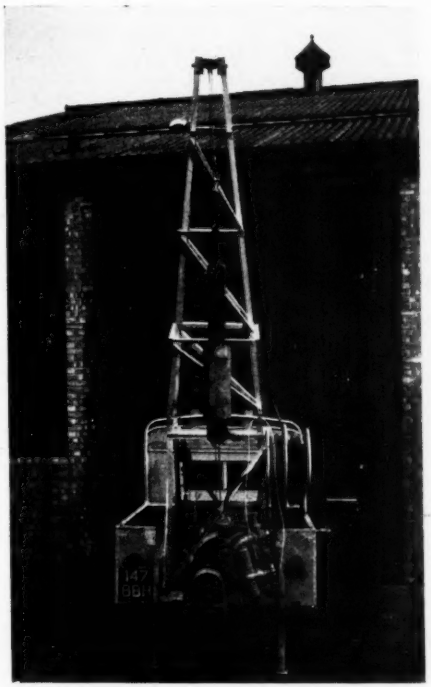
South-West Africa.—South African Minerals Corporation, Ltd., has decided that the best interests of the Corporation require that production of manganese ore should be suspended by August 31 this year, when all outstanding orders will have been fulfilled. The decision follows the recession in the world production of steel and consequent surpluses of manganese ore supplies. Contracts at present being offered to the Corporation provide little or no profit and much risk and might impair its financial soundness. The mine properties are being placed on a caretaking basis which will facilitate the resumption of production on the restoration of more propitious market conditions.

Central African Federation. — The Rhodesian associate of African Explosives and Chemical Industries, Ltd., is in the final stages of erecting a new superphosphate plant near Salisbury ; production is scheduled for the mid-year. Thereafter the group's output capacity will be sufficient for the requirements of the two territories for many years to come. Most of the raw phosphate will probably continue to be imported from Morocco. The parent company recently completed a world-wide survey of processes for the extended production of ammonia, the output capacity of which is being raised by 70,000 tons to 145,000 tons a year. Ammonia production in the new plant, which will involve an outlay of £10,000,000, will be based on the use of low-grade Transvaal coal, reserves of which are vast, instead of metallurgical coke, the potential output of which is limited and must be reserved for the steel industry. An existing plant now using coke will be converted for the use of low-grade coal as well. The whole project is scheduled for completion by about 1960. Then, of the total projected output of 145,000 tons of ammonia a year, about 25,000 tons a year only will be based on the use of coke. The associated Rand Carbide, Ltd., reports difficulties in export markets, mainly as the result of intensified competition and political disturbances in the Far East, but increasing sales of carbide on the domestic market for the manufacture of chemicals.

Aluminium Derrick for Mobile Drill

A mechanical jet drill designed by Dr. J. R. F. Joyce and built by Davenport Vernon, Ltd., for mounting on a Land Rover incorporates a folding aluminium-alloy derrick. Intended for mineral prospecting in West Africa the rig is used to position a mechanical hammer that drives tubing into the ground in order to obtain sub-surface samples which are forced up and out of the tube under pressure from a water-jet. Normally hand-operated drills of a type which break down into 60 lb. head loads for transportation and which require a crew of 10 or 11 men are used on such expeditions, but the new unit, needing a crew of only five is equivalent to four hand-drills and it is expected to bore between 180 ft. and 240 ft. per day in areas where drilling depths are unlikely to be greater than 30 ft.

The drive head of the drill consists of a cast-steel block (the hammer) weighing 250 lb., which forms a loose-fitting sleeve about a $2\frac{5}{8}$-in. diameter tube which is fitted with upper and lower stops to contain the block. The lower stop is a $5\frac{1}{2}$-in. diameter pallet, to which the drive pipe is screwed prior to the commencement of drilling. The hammer is attached by cable to an automatic winch, which is connected to a rear power take-off drive through an electrically operated clutch. The cable operates through a system of pulleys which provides the necessary back tension to enable the winch to pick up the hammer and the latter to operate at various heights. When the hammer falls—through a distance of 2 ft. 6 in.—it strikes the pallet at the lower end of the drive head and causes a travel switch attached to the top stop to close ; this completes an electric circuit and so energizes the clutch operating the winch,



Rear View of Drilling Unit.

Drill in Travelling Position.

which then raises the hammer until it touches the switch, breaking the circuit and making the hammer fall again. The rate of operation is designed to be 60 blows per minute, but by varying the engine speed a range from 40 to 80 blows per minute may be covered.

In order to carry the derrick, drive mechanism, winch and pumping equipment, and also a 60-gal. water tank the vehicle was specifically modified to increase its payload by welding stiffeners on the underside of the chassis and fitting supplementary rubber springs to those at the rear. With a load over the normal maximum weight saving wherever possible was of prime importance and so the use of aluminium alloy for the derrick was considered essential. Using Noral B51SWP (an alloy with a high strength/weight ratio supplied by the Northern Aluminium Co., Ltd., who also assisted with the design of the structure) the weight was only 80 lb. This showed a saving of 60 lb. as compared with an equivalent tubular steel derrick and kept the total load on the chassis just below the maximum allowable. An additional advantage gained by using aluminium is that the structure is used unpainted, as the natural oxide coating on the metal protects it from all weathers and renders painting unnecessary.

The derrick, which is 14 ft. high when extended, is constructed of $1\frac{1}{2}$ in. by $\frac{3}{16}$ in. angle. Reinforced at certain points with 6 s.w.g. sheet, also of Noral B51SWP, it is fastened with anodized alloy bolts secured with self-locking nuts. It is bolted to the chassis through a baseplate at six points where the tops of the chassis members have been specially built up to ensure that the structure is firmly anchored. While the vehicle is travelling the upper portion of the derrick is folded over the cab and secured by an elastic rope to the spare-wheel mounting on the bonnet.

An auxiliary trailer tank of tank-chassis construction with a capacity of 250 gal. holds ample water for two to three days' drilling provided the correct water recovery procedure is followed ; it also carries 200 ft. of drive pipe.

Steel Wire Ropes

Last year British Steel Wire Rope Standards serving the mining and engineering industries were revised, with the object of rationalizing the sizes and constructions in use and relating these to technical improvements in wire and wire rope manufacture. The salient features of the revision covering B.S.S. 236/57, B.S.S. 330/57, B.S.S. 302 and 621/57, and B.S.S. 329/57 are : The size of the rope is now based on diameter, the effects of this being particularly noticeable in the case of haulage ropes, which have traditionally tended to be full to size and with flattened-strand constructions. To simplify

the tables round-strand rope constructions have been formed into four groups within which emphasis is given to the use of Seale or equal-laid construction ; flattened-strand ropes, however, have an additional table covering the more flexible constructions. Tensile ranges are generally limited to 100–110 tons/sq. in. and 110–120 tons/sq. in., the exception being lift and hoist ropes, where 70–80 tons/sq. in. and 80–90 tons/sq. in. are standard and certain haulage ropes using 80–90 tons/sq. in. The use of basic-quality steel is permitted for all rope specifications, this being due in part to the limited supply of acid quality and to the improvement in the quality of basic. Physical test requirements for acid and basic are identical and basic can therefore be used with confidence. The use of acid, however, will still be advisable for special-duty ropes.

The galvanizing specification has been split between a heavy coat weight (B.S. 443) combined with lower physical wire properties and a lighter coat weight on wire having the same physical properties as ungalvanized wire (B.S. 2763).

Trade Notes

Brief description of a development of interest to the mining engineer

Novel Handling System

A demonstration was recently given of the Marrel multi-container handling system at Cresswell Colliery, Derbyshire. In principle it derives from fork lifting and pallet handling and makes use of standard lorries of various sizes fitted with a hydraulic device for self-loading and self-unloading. It permits of the rapid handling of a variety of containers—such as, skips, buckets, and mobile hoppers. The containers, it may be noted from the illustration, are completely divorced from the truck chassis which carries them, all operations being controlled by the driver of the truck who operates in the cab.

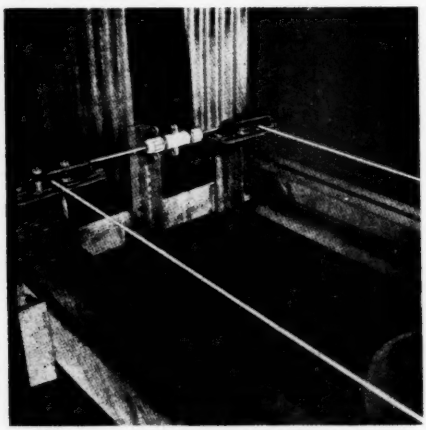
In the demonstration a standard 6-wheeled Foden truck was used to which had been fitted the special hydraulic equipment. Manufactured by Beunes-Marrel of St.

Marrel Multi-Container.

Etienne, it is well known in quarries in France. The concessionaires in this country are Aero Maintenance Equipment, Ltd., on whose behalf the demonstration was arranged by **Berresford Concessions, Ltd.,** of Saltergate, Chesterfield.

Trip Wire Conveyor System

In a note on the exhibit by **Hugh Wood and Co., Ltd.,** of Royal London House, Finsbury Square, London, E.C. 2, at the Mechanical Handling Exhibition, which appears elsewhere is reference to a signalling and control system for conveyors. This consists of a length of concentric cable with "clean break" type switches inserted at

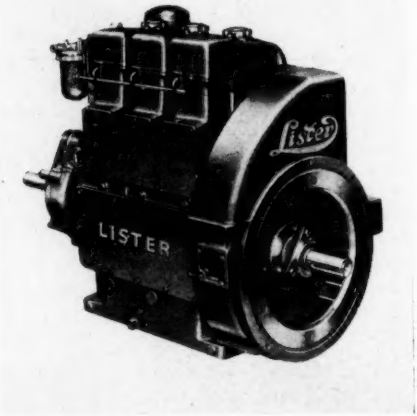


Huwood Trip Wire.

intervals. The wire has been designed for use on a low-voltage intrinsically-safe supply and replaces the old twin bare-wire system. It is made up of a centre core of steel wire surrounded by an insulated cover, a concentric screen of wire, and an outer insulating cover. In the control panel in normal practice a rectifier is mounted at the remote end of the twin bare wires. This rectifier allows through a half-wave current to a relay situated in the panel, maintaining this relay in an energized position. When the bare wires are short circuited the remote rectifier is cut out allowing a full-wave current to flow which reduces the effective flux in the relay coil, allowing it to drop out. The same method of operation can be obtained by the use of the trip wire and signal switches in place of the twin bare wires, the only difference being that the system is opened when the wire is deflected instead of short-circuited. In this case the steel centre core of the trip wire takes the place of one bare wire and the concentric wire screen the other. In the illustration the wire is shown running round the pulleys of the tail end. It is normal for the signal switches to be placed at intervals of 90 ft. and when the wire is deflected between switches this opens a pair of contacts fitted into the signal switch which will break the circuit, de-energizing the relay in the panel, thus stopping the controlled conveyor(s) or haulage system.

Air-Cooled Diesel Engines

Last month **R. A. Lister and Co., Ltd.,** of Dursley Gloucestershire, exhibited two new air-cooled diesel engines, additions to the range of such units for which they are already well known The new engines (the HA2 and HA3) are rated at 20 h.p. at 1,800 r.p.m. for the twin-cylinder version and at 30 h.p. at the same speed for the three-cylinder engine. The engines can be provided with alternative speeds and power outputs at lower speeds, the ratings being continuous, in accordance with the latest British Standard. This series of engines is, it is stated, a direct development



SL3 Air-Cooled Diesel.

of the present smaller air-cooled types (LD1 and LD2), many of the characteristics of which—notably, simplicity of design, exceptionally good starting, an economic fuel consumption, and reliability—they have inherited. Direct injection for the fuel is provided by an injector of a patented design in conjunction with a unique combustion chamber in the piston crown. These engines, it is considered, form convenient and readily adaptable power units suitable for a wide sphere of industrial applications. Illustrated here is a Lister 3-cylinder model (SL3) rated at 12·75 h.p. and 1,800 r.p.m., one of three new additions to the older range which has been extended by increasing the cylinder bore. The power output of this type of engine bridges the gap between the established smaller engines and the new range of 20-h.p. and 30-h.p. air-cooled units.

The Tellurometer System

In a note on their exhibit at the Instruments, Electronics, and Automation Exhibition in the May issue reference was made to the Tellurometer shown by **Cooke, Troughton, and Simms, Ltd.,** of Haxby Road, York. As many readers will be aware this is an instrument for the precise measurement of distance by radio microwaves. The system operates in the 10 cm. wavelength region and measures the travel time of radio waves over the length to be determined with an accuracy of a fraction of a millimicrosecond. Measurements can be made by day or by night and visibility is immaterial. To measure a single line one master station and one remote station are necessary. A built-in duplex radio telephone circuit is included and is used in the procedure. If a number of remote stations are employed a number of lines may be measured from the master station in the course of one operation with possible economies in transport and time. The instruments at master and remote stations are physically similar but are not interchangeable, both being self-contained units with built-in aerial systems. The telescopic tripod has a centring adjustment to facilitate the positioning of the electrical centre of the instrument over the point from which measurements are being taken. Plumb-bob and line are provided. Special attention has been given to portability. The set itself is provided with a handle, enabling it to be carried as if it were an attache case and back straps are also provided. The power pack has a shoulder strap and the tripod is provided with a leather strap and carrying handle, the method of carrying the battery being left to user's choice.

Personal

P. H. ANDERSON is the new president of the Transvaal and O.F.S. Chamber of Mines.

EDWIN BARNARD, formerly manager of the excavator department at Ransomes and Rapier, Ltd., and well known to many mining men, retired at the end of June.

FRED A. BRINKER, formerly chief metallurgist, Western Division of the Vanadium Corporation of America, has been appointed an assistant vice-president.

W. J. BUSCHAU has been elected a vice-president of the Transvaal and O.F.S. Chamber of Mines.

I. M. CAMPBELL RODGER is now a director of the Johannesburg Consolidated Investment Co., Ltd.

W. NIVEN CARNAGHAN has left for Ghana.

J. R. CHILES is home from India.

J. E. DENYER has joined the board of South Crofty, Ltd.

F. T. C. DOUGHTY is making a short visit to the United States.

C. TREHARNE JONES has been appointed to the board of Dowty Mining Developments, Ltd.

N. K. KINKHEAD-WOAKES has been made a manager of the Anglo American Corporation of South Africa, Ltd.

H. C. KOCH has been elected a vice-president of the Transvaal and O.F.S. Chamber of Mines.

F. B. LAWRENCE now represents Ruston-Bucyrus, Ltd., in South-West England.

M. T. O'REGAN is home from Nigeria.

V. H. OSBORN, Secretary for Mines in the South African Government, is to retire in October next.

G. W. H. RELLY has been made a manager of the Anglo American Corporation of South Africa, Ltd.

J. N. REVILL now represents Ruston-Bucyrus, Ltd., in South Wales.

JOHN S. RINEHART, assistant director of the Smithsonian Astrophysical Observatory and an astronomy research associate at Harvard University, is to become a full professor of mining engineering at the Colorado School of Mines in the autumn.

J. L. RITCHIE has been appointed as personal assistant to the managing director of the Consolidated Pneumatic Tool Co., Ltd.

D. J. ROGERS has been appointed a consulting engineer with New Consolidated Gold Fields, Ltd.

D. E. SMITH is home from Ghana.

SYDNEY E. TAYLOR has been appointed a director of Mawchi Mines, Ltd.

G. H. N. TODD is now vice-chairman of Burma Mines, Ltd.

MICHAEL E. WOAKES was here from the United States on his way to Northern Rhodesia.

Metal Markets

During June [1]

Copper.—On balance copper prices have improved by some £15 per ton during June but the peak of prices was at one time some £8 per ton higher than the level at which the month closed.[2] A very substantial proportion of the fluctuations which have occurred is attributable to political developments in the U.S.A., although there have been complicating factors in addition. Typical of these may be mentioned the U.K. dock strike, which prompted the Board of Trade to make available from the stockpile some 2,000 tons of copper to U.K. consumers who could show that they had been adversely affected by the strike. Towards the end of the month some anxiety was occasioned by the threat of a strike at the El Teniente mine in Chile but, in the event, this was averted.

Of the variety of political events in America undoubtedly the most important was the proposal made for instituting a new programme for stockpiling U.S. copper for a period of one year. The proposal to absorb some 150,000 short tons of copper at market prices up to 27½ cents per lb. has already surmounted its first hurdle in being approved by a Senate Interior Committee. It still has other obstacles to overcome before achieving finality but knowledgeable Washington circles suggest that these should be cleared with only moderate difficulty. Like so many other political moves in the U.S.A. the copper stockpiling proposal is partly dependent on other factors of the same nature. In particular the fact (as elaborated in the relevant sections) that stockpiling has been rejected for lead and zinc in favour of the minerals stabilization proposals may have a bearing on the situation especially as a lead-zinc tariff now looks unlikely. On July 1, of course, the U.S. tariff on copper automatically reverted to 1·7 cents per lb., a point on which there was not much doubt for most of the month although in the early days of June several moves were known to be afoot to continue the suspension of the duty.

Taking the probability that the U.S. domestic price will ultimately be 27½ cents per lb. (at present only two producers are quoting 26½ cents per lb., the third still quoting 25 cents) the duty still makes the effective U.S. market price from the London point of view not very encouraging when compared with the prices already prevailing in London. With holidays at consuming works impending, both in the U.S.A. and Europe, the general outlook is dull although not disastrously depressing.

Copper consumption in the U.K. in April was 55,506 tons, of which 43,784 tons was refined. Production of primary refined copper was 8,825 tons and of secondary refined 8,140 tons. During the month stocks of refined copper dropped to 69,757 tons but stocks of blister stayed virtually unchanged at 18,825 tons.

Tin.—The only variation from the fairly even pattern of tin prices [1] in June—*i.e.*, cash at £730 per ton and a small contango—came just before the meeting of the International Tin Council in Paris on June 17. As when the previous meeting was held market goodwill on tin deteriorated seriously and a backwardation made a temporary appearance. Many people feel these displays of nerves, which have become a feature of the tin market, are somewhat supererogatory when the attitude of the Tin Council has been unambiguously expressed on a number of occasions. A concession must be made to the natural instincts of the market which have been fairly well suppressed by Buffer Stock buying from time to time. On a " normal " basis the size of the stocks held by the Buffer Stock would be a big enough bear factor to depress the price by hundreds of pounds a ton.

Consumption of tin in the U.K. in April was 1,725 tons, so that after only four months of 1958 consumption had dropped over 1,000 tons below the corresponding period of 1957. Production was 1,790 tons.

Lead.—American political developments have twisted the tail of the lead market [1] on a variety of occasions in June although there has probably been rather more excitement in proportion to the fluctuations that have taken place than is often the case. It will be remembered that a stabilization programme was introduced fairly recently which sought to effect a net return to U.S. mines of 14¾ cents per lb. During June after the copper stockpiling proposal was introduced expectation ran high for a similar support for lead and zinc, despite the fact that the old stockpiling programme had only terminated a short while before. After disappointment that stockpiling was not proposed at the time that the stabilization was formally introduced there was excitement over the introduction of a programme to stockpile 100,000 short tons of lead at up to 14¾ cents. This quickly gave way to dismay at the rejection of the proposal by a Senate Interior Committee, especially as the committee approved

[1] Recent prices, pp. 8, 48.
[2] See Table, p. 48.

[1] See Table, p. 48.

the minerals stabilization proposal for lead, but in a form modified to give no encouragement to markets outside the U.S.A. even though the net return which it was designed to give U.S. miners was advanced to 15½ cents. Assuming the stabilization proposals eventually become law (and this is an open question) the outlook for non-U.S. markets, especially with holidays approaching, is for little alteration in the situation.

U.K. April lead consumption was 26,230 tons with production 6,259 tons and stocks slightly down to 37,509 tons.

Zinc.—Being subject to identical political developments in the U.S.A. zinc has followed the same course in June as lead, although the variations in London prices [1] in response to the several developments have not always been with the same emphasis. The position of zinc if the stabilization proposals became effective would now be that the stabilization price would be 13½ cents but the maximum subsidy would be 4 cents per lb. (the same as for lead). Foreign metal thus effectively has to compete with a price of 9½ cents, after paying duty and freight. For the London market this is hardly a bull point.

Consumption of zinc in the U.K. in April was 24,984 tons, production 7,204 tons, and stocks at the end of the month 47,251 tons.

Iron and Steel.—In May United Kingdom total imports of iron and steel fell to 60,064 tons—the lowest level since 1954—and half of this figure comprised ferro-alloys and sheet steel. Exports in the same month were 255,037 tons, more or less unchanged on the previous month, but making for the first five months of 1958 only 1,191,625 tons against 1,381,488 tons in the corresponding period of 1957. These statistics reveal the current pattern of the steel trade in Britain.

At home while consumption generally is fairly well maintained consumers are reducing the enormous stocks of steel they have built up over the past years of shortage and this has meant a much reduced flow of orders for the mills. As a result short time and dismissals have become quite common and steel production is falling sharply. An output this year of 20,000,000 tons or less against 21,700,000 tons last year is quite on the cards. On the export market competition is very severe for the reduced amount of business available and all hopes of increasing British sales overseas this year have been abandoned. No catastrophic decline in exports has occurred yet, however, but conditions may worsen as the year progresses.

The consumption of steel at home, while still high, shows signs of tapering off to some extent, but the motor-car industry seems set for continued prosperity. May car exports were a record. The industry is absorbing vast quantities of sheet steel and is having to supplement home production with foreign material. In the first five months of this year 121,205 tons of sheets were imported, mostly for the motor-car industry.

Iron Ore.—Imports in May into the U.K. rose to 1,313,554 tons from 1,046,621 tons in April. Home iron-ore production has been reduced.

Aluminium.—The past month has seen very little change in the overall world aluminium picture. The price in the United Kingdom for minimum 99·5% purity ingots is still quoted at £180 a ton delivered, while prices of Russian and Soviet Bloc material recently quotable at £164 to £172 a ton delivered are now said to have been reduced to £159 to £161 a ton. The material priced at the lower end of this range, £159 a ton, is said to be offered by Hungary on the world market, while the £161 level is for material of Russian origin. With metal being offered at this extremely low level it is little wonder that certain consumers are unwilling to pay the comparatively high price asked by the sellers of Canadian metal in this country.

In an attempt to bring about some degree of stability in the U.S. semis market some fabricators are reported to have announced new quoted prices at levels much nearer the actual market ideas—some 10% to 12% under the previously listed prices—and are sticking to them. Previous to this move cuts of up to 30% under mills' list prices had become quite common. Legislation has been introduced into the U.S. House of Representatives to restore the U.S. import duty on aluminium to 4 cents a lb. A proposal was also made in the U.S.A. to stockpile some 150,000 tons of aluminium at 27 cents, but this was quickly given its quietus by the Senate Interior committee.

In the United Kingdom another move has been made towards the possibility of dealing in aluminium on the London Metal Exchange. Members with ideas or proposals about such a scheme have been asked to communicate their views to the secretary of the L.M.E.

Antimony.—As was mentioned in the previous report the outlook for antimony was not particularly bright. Consumer buying interest during June was meagre and prices have remained unchanged from previous levels, English regulus being quoted at £197 10s. a ton delivered.

Arsenic.—There is nothing fresh to report regarding arsenic and trioxide is still quoted at £40 to £45 a ton and metal at £400 a ton. Imports of arsenic trioxide into the U.K. during May totalled 157 tons compared with 220 tons in April and 574 tons in May, 1957.

Bismuth.—The bismuth market in June was almost completely devoid of any interest and the price of metal remained unchanged at 16s. per lb. Imports into the U.K. totalled 86,201 lb. during May, less than in the previous month.

Cobalt.—June seems to have been a quiet month for a number of metals and cobalt was no exception. On the whole the position remains unaltered with little sign of any new factors entering the market in the near future. The price in the U.K. is still quoted at 16s. per lb. U.K. imports during May totalled 128,657 lb.

Cadmium.—This metal is still quoted in this country at 10s. a lb. with the general position unaltered and little sign of any possible movement in the near future. Imports during May amounted to 149,141 lb. compared with 134,251 lb. in the previous month.

Chromium.—There was nothing new to report on chromium during June and once again the price is quoted at 6s. 11d. to 7s. 4d. per lb.

Tantalum.—Imports of columbite-tantalite into the United Kingdom during May fell to only 19 tons from the previous month's total of 88 tons, which considering the March imports of only 22 tons seems somewhat unusual. The total for the first five months of the year of 207 tons compares with 254 tons in the same period of 1957. 60% ore in the U.K. is still quotable at 900s. to 1,000s. per unit.

[1] See Table, p. 48.

Platinum.—Once again the platinum market is in the doldrums and the open-market price has fallen once again. At present it is very difficult to foresee if and when this situation will become more stable. The price of U.K. and Empire refined material is still quoted at £25 a troy oz. with open-market material at the lower level of £20 15s. to £21 15s. a troy oz. and very little consumer buying interest being shown.

Iridium.—Iridium suffered a fall in price during June and is now quoted in a not very strong market at from £20 to £23 per troy oz.

Osmium.—This is another platinum-group metal which is in a somewhat precarious position and has suffered a price fall in the past four weeks. It is now quotable at £18 per troy oz. compared with the previous range of £18 to £20.

Palladium.—Unlike the other platinum metals palladium did not follow the latest downward price trend and although business in this metal is far from being brisk the price is still quoted at £5 to £5 15s. per troy oz. Imports of platinum-group metals during May totalled 7,530 oz. compared with almost 24,000 oz. in the same period of 1957. However, the total imports for the first five months of this year at 66,798 oz. are higher than the comparable figure for 1957 by over 20,000 oz.

Tellurium.—This metal has followed its usual uninspiring course during the past four weeks and is still quotable at 15s. to 16s. per lb.

Tungsten.—During the past month tungsten has pursued a downward path and business has not been particularly brisk. With offers from Russia increasing and ferro-alloy makers out of the market in many cases the price has fallen to 66s. to 76s. 6d. per long ton unit of WO_3, c.i.f. Europe.

Nickel.—While the leading Canadian supplier continues to quote £600 a ton for nickel, supplies on the open market are occasionally obtainable at prices ranging from £50 to £100 below this figure. Despite this and the cuts in production made by Inco (something like 25,000 short tons a year) there are still no indications that the Canadian company is contemplating any reduction in its price. As is well known the company's policy is one of long-term stability of prices and it is sticking to this, perhaps in the expectation of an increase in U.S. requirements in the not too distant future.

Chromium.—Following the reductions in the contract prices of Rhodesian chrome ore in May the market generally has been quiet. How far the reductions have helped in reducing stocks is not yet known and it is doubtful if the effect of the reductions will be felt to any great extent for at least a few months. Metallurgical grade 48% ore is still quoted at £16 5s. a ton c.i.f.

Molybdenum.—The position of oversupply in this metal still continues and the market remains quiet. Output at the Climax plant is still at a reduced rate in an attempt to bring the supply and demand position into something resembling balance. The price in this country continues to be quoted at 8s. 5d. per lb. of Mo, f.o.b. Climax, Colorado.

Manganese.—Following a reduction in freight rates late in June the price of manganese ore was reduced accordingly and is now quoted at 96d. to 100d. per unit of metal contained. As has been mentioned in previous reports U.K. consumers are fully bought for the current year and the present depressed state of the European market, with substantially lower ferro-manganese prices obtaining in this country, are additional factors holding the price down.

Tin, Copper, Lead, and Zinc Markets

Tin, minimum, 99·75%; Copper, electro; Lead, minimum 99·75%; and Zinc, minimum 98% per ton.

Date		Tin		Copper		Lead		Zinc	
		Settlement	3 Months	Spot	3 Months	Spot	3 Months	Spot	3 Months
		£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
June	12	730 10	734 5	199 2½	201 5	74 2½	75 7½	65 12½	65 17½
	13	730 10	732 15	200 2½	202 5	72 11¼	73 16¼	64 2½	64 16¼
	16	730 10	729 5	200 15	201 15	72 17½	73 8¾	64 1¼	64 13¾
	17	730 10	728 5	204 10	205 12½	73 7½	74 3¾	65 2½	65 13¾
	18	730 10	732 5	205 12½	206 7½	77 2½	77 18¾	67 7½	67 17½
	19	731 0	733 15	203 15	204 7½	78 0	79 2½	66 2½	66 17½
	20	730 10	731 15	198 2½	198 17½	73 12½	74 17½	63 17½	64 7½
	23	730 10	731 15	194 12½	195 12½	74 2½	75 7½	65 5	65 12½
	24	730 10	731 15	196 12½	196 17½	74 12½	75 17½	65 2½	65 13¾
	25	730 10	732 5	196 12½	196 17½	75 2½	76 2½	65 11¼	65 18¾
	26	730 10	733 15	199 2½	199 12½	75 2½	76 2½	65 13¾	66 3¾
	27	730 10	732 5	198 7½	199 7½	75 1¼	76 8¾	65 12½	66 3¾
	30	730 10	732 5	197 2½	197 10	72 7½	74 2½	63 15	64 2½
July	1	730 10	731 5	195 17½	196 17½	73 2½	73 18¾	63 6¼	63 18¾
	2	730 10	730 15	195 2½	196 2½	72 10	73 6¼	63 1¼	63 6¼
	3	730 10	730 15	193 2½	194 15	71 17½	72 16¼	62 13¾	63 1¼
	4	730 10	729 5	191 10	192 12½	71 12½	73 3¾	62 15	63 7½
	7	730 10	729 5	193 5	194 12½	71 15	73 3¾	62 16¼	63 6¼
	8	730 10	730 15	196 5	197 12½	71 17½	73 8¾	63 7½	63 17½
	9	731 0	731 5	196 15	197 5	71 17½	73 11¼	63 12½	64 2½
	10	—	—	—	—	—	—	—	—

Statistics

TRANSVAAL AND O.F.S. GOLD OUTPUTS

	May		June	
	Treated Tons.	Yield Oz.†	Treated Tons.	Yield Oz.*
Blyvooruitzicht	112,000	64,485	101,000	62,099
Brakpan	129,000	16,634	126,000	16,176
Buffelsfontein‡	117,000	39,081	117,000	39,145
City Deep	148,000	28,250	108,000	22,026
Cons. Main Reef	142,000	21,894	140,000	20,600
Crown Mines	238,000	36,130	225,000	33,966
Daggafontein	238,000	49,261	242,000	49,843
Doornfontein‡	88,000	36,630	88,000	36,766
D'rb'n Roodeport Deep	187,000	33,832	182,000	32,895
East Champ D'Or‡	12,500	345	12,500	357
East Daggafontein	92,000	15,281	92,000	15,277
East Geduld	135,000	41,525	125,000	38,448
East Rand P.M.	230,000	58,705	222,000	56,209
Eastern Transvaal Consol	18,700	6,610	18,600	6,603
Ellaton‡	32,000	7,467	33,000	7,684
Freddies Consol.	55,000	14,423	56,000	14,529
Free State Geduld	68,500	49,112	69,000	49,433
Geduld	83,000	13,086	73,000	12,240
Government G.M. Areas‡	64,500	11,052	61,000	11,490
Grootvlei Proprietary	205,000	43,571	195,000	41,558
Harmony Gold Mining	78,000	30,826	78,000	30,501
Hartebeestfontein‡	85,000	46,750	87,000	47,415
Libanon	100,000	22,972	98,000	22,791
Loraine	72,000	13,266	74,000	13,788
Luipaards Vlei‡	120,000	13,904	120,000	14,023
Marievale Consolidated	74,000	19,348	69,000	18,117
Merriespruit‡	—	—	—	—
Modderfontein East	148,000	13,779	136,000	12,907
New Kleinfontein	88,000	10,353	84,000	10,227
New Klerksdorp‡	10,400	1,170	10,100	1,057
President Brand	87,500	65,843	90,500	67,862
President Steyn	98,000	37,423	99,000	37,609
Rand Leases	174,000	25,665	177,000	25,695
Randfontein‡	194,000	15,806	193,000	14,983
Rietfontein Consolid't'd.	21,500	4,987	21,500	4,957
Robinson Deep	72,000	15,473	70,000	14,931
Rose Deep	60,000	7,273	57,000	7,047
St. Helena Gold Mines	119,000	34,941	118,000	34,344
Simmer and Jack	88,000	16,687	90,500	16,958
S. African Land and Ex.	91,000	18,473	92,500	18,805
S. Roodepoort M.R.	30,000	7,121	28,000	6,680
Spaarwater Gold	10,700	3,294	10,700	3,296
Springs	127,000	14,074	128,000	14,204
Stilfontein Gold Mining‡	112,000	55,496	113,000	55,805
Sub Nigel	66,500	16,070	66,500	15,910
Transvaal G.M. Estates	17,100	2,232	—	—
Vaal Reefs‡	72,000	32,400	74,000	33,303
Van Dyk Consolidated	78,000	14,991	75,000	14,041
Venterspost Gold	127,000	30,004	89,000	21,102
Village Main Reef	29,000	4,495	30,000	4,692
Virginia O.F.S.‡	101,000	26,422	101,000	26,664
Vlakfontein	50,000	17,613	50,000	17,739
Vogelstruisbult‡	96,000	21,274	96,000	21,252
Welkom Gold Mining	87,500	26,082	90,000	26,788
West Driefontein‡	77,500	74,227	78,500	75,241
West Rand Consol.‡	209,000	21,358	206,000	21,023
Western Holdings	98,000	54,739	100,000	55,950
Western Reefs	114,500	26,909	114,500	26,793
Witwatersrand Nigel	17,600	4,352	17,700	4,342

† 248s. 4d. * 249s. 0d. ‡ Gold and Uranium.

COST AND PROFIT IN THE UNION

	Tons milled	Yield per ton	Work'g cost per ton	Work'g profit per ton	Total working profit
		s. d.	s. d.	s. d.	£
Mar., 1957.	16,430,800	60 8	44 8	16 0	20,657,462
April	—	—	—	—	—
May	—	—	—	—	—
June*	16,785,200	62 4	45 1	17 3	22,595,371
July	—	—	—	—	—
August	—	—	—	—	—
Sept.*	16,699,900	64 0	45 6	17 3	24,193,575
Oct.	—	—	—	—	—
Nov.	—	—	—	—	—
Dec.	16,198,500	64 4	46 1	18 3	23,695,380
Jan., 1958.	—	—	—	—	—
Feb.	—	—	—	—	—
Mar.	15,806,300	64 10	46 6	18 4	23,170,987

* 3 Months..

PRODUCTION OF GOLD IN SOUTH AFRICA

	Rand and O.F.S.	Outside	Total
	Oz.	Oz.	Oz.
June, 1957	1,405,307	24,957	1,420,021
July	1,395,064	53,099	1,479,439
August	1,426,340	38,941	1,459,794
September	1,400,745	37,611	1,438,356
October	1,416,211	39,996	1,456,207
November	1,386,047	36,470	1,422,517
December	1,366,354	35,789	1,402,143
January, 1958	1,377,505	40,534	1,418,039
February	1,322,843	33,879	1,356,722
March	1,394,956	36,330	1,431,286
April	1,401,094	38,352	1,439,446
May	1,435,960	36,494	1,472,454

NATIVES EMPLOYED IN THE SOUTH AFRICAN MINES

	Gold Mines	Coal Mines	Total
September 30, 1957	315,955	28,170	344,125
October 31	310,428	28,020	338,448
November 30	305,104	27,619	332,723
December 31	299,137	27,623	326,760
January 31, 1958	314,239	28,489	342,728
February 28	326,885	30,227	357,112
March, 31	333,862	31,203	365,065
April, 30	337,284	31,424	368,708
May 31	337,464	31,509	368,973

MISCELLANEOUS METAL OUTPUTS

	4-Week Period To May 31		
	Tons Ore	Lead Concs. tons	Zinc Concs. tons
Broken Hill South	26,680	4,167	4,634
Electrolytic Zinc	17,200	799	5,314
Lake George	18,309	1,472	2,800
Mount Isa Mines**	70,206	4,245†	2,541
New Broken Hill	38,110	5,675	9,055
North Broken Hill	29,693	6,401	6,339
Zinc Corp.	57,490	9,793	10,574
Rhodesia Broken Hill*	—	3,250†	7,475†

* 3 Mths. ** Copper 2,970 tons. † Metal.

RHODESIAN GOLD OUTPUTS

	May		June	
	Tons	Oz.	Tons	Oz.
Cam and Motor	30,939	9,767	—	—
Falcon Mines	210750	4,261	22,300	4,300
Globe and Phœnix	6,200	3,586	6,000	3,598
Motapa Gold Mining	15,700	1,944	—	—
Mazoe	3,025	861	—	—
Coronation Syndicate	11,447	2,310	—	—
Phoenix Prince*	—	—	—	—

* 3 Months

WEST AFRICAN GOLD OUTPUTS

	May		June	
	Tons	Oz.	Tons	Oz.
Amalgamated Banket	60,062	13,811	59,091	13,923
Ariston Gold Mines	37,590	11,937	36,500	12,323
Ashanti Goldfields	31,250	22,750	31,500	23,500
Bibiani	35,000	6,900	33,500	6,900
Bremang	—	4,187	—	5,533
Ghana Main Reef	11,371	4,263	11,157	4,296
Konongo	5,820	3,950	5,820	3,857
Lyndhurst	—	—	—	—

PRODUCTION OF GOLD AND SILVER IN RHODESIA

	1957		1958	
	Gold (oz.)	Silver (oz.)	Gold (oz.)	Silver (oz.)
January	44,337	6,134	44,305	46,553
February	41,607	5,697	43,591	21,313
March	43,831	8,179	43,830	8,179
April	46,754	6,854	46,587	22,573
May	42,650	5,606	46,015	19,937
June	46,682	6,441	—	—
July	41,922	5,781	—	—
August	44,001	5,897	—	—
September	45,702	5,677	—	—
October	46,838	5,570	—	—
November	46,987	6,331	—	—
December	45,479	5,814	—	—

WESTRALIAN GOLD PRODUCTION

	1956	1957	1958
	Oz.	Oz.	Oz.
January	66,388	106,722	66,562
February	94,638	64,949	65,965
March	66,944	67,121	65,420
April	60,415	66,435	60,855
May	62,294	64,886	64,196
June	63,570	65,142	—
July	69,883	74,420	—
August	72,303	75,727	—
September	62,204	64,422	—
October	64,594	64,524	—
November	64,113	65,700	—
December	65,031	66,562	—
Total	812,377	846,610	842,004

AUSTRALIAN GOLD OUTPUTS

	4-Week Period			
	To May 13		To June 9	
	Tons	Oz.	Tons	Oz.
Central Norseman	14,143	7,609	—	—
Crœsus Proprietary	—	—	—	—
Gold Mines of Kalgoorlie	38,117	9,613	—	—
Golden Horse Shoe*	—	—	—	—
Gt. Boulder Gold Mines*	114,823	27,667	—	—
Gt. Western Consolidated	32,297	5,984	—	—
Hill 50	9,879	5,629	—	—
Kalgurli Ore Treatment	—	—	—	—
Lake View and Star*	—	—	—	—
Moonlight Wiluna*	—	—	8,227	3,566
Morning Star (G.M.A.)	956	406	1,433	849
Mount Ida	—	—	—	—
New Coolgardie	—	—	—	—
North Kalgurli	26,713	—	26,313	5,930
Sons of Gwalia	11,650	2,280	11,260	2,520
Mount Morgan	—	3,580	—	4,807

* 3 Months.

ONTARIO GOLD AND SILVER OUTPUT

	Tons Milled	Gold Oz.	Silver Oz.	Value Canad'n $
Jan., 1957	759,681	210,404	33,082	7,114,391
February	702,636	197,225	32,199	6,635,527
March	793,674	215,830	35,787	7,250,018
April	771,608	216,457	35,685	7,314,450
May	790,159	222,436	37,241	7,509,638
June	738,384	207,897	32,544	6,945,127
July	718,468	198,620	30,620	6,572,323
August	701.174	192,453	31,647	6,410,429
September	722,384	205,471	34,248	6,947,813
October	772,383	224,217	37,086	7,657,426
November	756,494	219,352	37,737	7,441,702
December	750,537	215,462	44,230	7,494,289
January, 1958	779,128	219,502	31,562	7,462,598
February	727,170	210,646	35,370	7,248,333
March	807,458	229,361	38,323	7,873,264
April	785,264	228,590	35,712	7,789,644

MISCELLANEOUS GOLD AND SILVER OUTPUTS

	May		June	
	Tons	Oz.	Tons	Oz.
British Guiana Cons.	—	1,107	—	—
Central Victoria Dredging	—	—	—	—
Clutha River	—	337	—	588
Emperor Mines (Fiji)*	46,315	17,906	—	—
Frontino Gold (Colombia)	—	—	—	—
Geita Gold (Tanganyika)	—	—	—	—
Harrietville (Aust.)	—	—	—	—
Lampa (Peru)†	—	37,948	—	36,660
Loloma (Fiji)*	—	—	—	—
New Guinea Goldfields	4,228	988	—	—
St. John d'el Rey (Brazil)	—	—	—	—
Yukon Consol.	—	$172,000	—	$318,000

* 3 Months. † Ozs. Silver: 60 tons copper, 61 tons.

OUTPUTS OF MALAYAN TIN COMPANIES IN LONG TONS OF CONCENTRATES

	Apr.	May	June
Ampat Tin	76½	76	—
Austral Amalgamated	—	—	—
Ayer Hitam	—	—	—
Batu Selangor	—	—	—
Berjuntai	176	126½	—
Chenderiang	—	—	20*
Gopeng Consolidated	—	—	—
Hongkong Tin	—	—	49*
Idris Hydraulic	—	—	—
Ipoh	—	—	—
Jelapang Tin	—	—	—
Kampong Lanjut	80	61	—
Kamunting	104	115	—
Kent (F.M.S.)	—	—	—
Kepong	—	—	—
Killinghall	—	—	53*
Kinta Kellas	—	—	—
Kinta Tin Mines	—	—	54½*
Klang River	—	—	—
Kramat	30	31	—
Kuala Kampar	85½	103	—
Kuala Lumpur	—	—	—
Kuchai	—	—	—
Lahat Mines	—	—	—
Larut	30	—	—
Lower Perak	130½	136	—
Malayan	—	—	—
Malaysiam	7	4½	—
Pacific Tin Consolidated	—	—	—
Pahang Consolidated	—	—	415*
Pengkalen	—	—	—
Petaling Tin	—	—	138*
Puket	—	—	—
Rahman Hydraulic	—	—	—
Rambutan	—	—	—
Rantau	72½	49	—
Rawang Concessions	—	—	—
Rawang Tin Fields	—	—	—
Renong	—	—	—
Selayang	—	—	—
Siamese Tin Syndicate (Malaya)	15	—	8
Southern Kinta	340	296	—
Southern Malayan	—	—	—
Southern Tronoh	—	—	—
Sungei Besi	—	—	—
Sungei Kinta	—	—	—
Sungei Way	—	—	—
Taiping Consolidated	47½	37½	—
Tambah	—	—	—
Tanjong	—	—	119*
Tekka	—	—	—
Tekka-Taiping	31	—	—
Temoh	—	—	—
Tongkah Compound	—	—	—
Tongkah Harbour	51	25	—
Tronoh	—	—	—
Ulu Klang	—	—	—

* 3 months.

MISCELLANEOUS TIN COMPANIES' OUTPUTS IN LONG TONS OF CONCENTRATES

	May.		June	
	Tin	Columbite	Tin	Columbite
Amalgamated Tin Mines ..	332	39	—	—
Anglo-Burma Tin	31	—	—	—
Bangrin	91	—	15	—
Beralt	58	105†	54	80†
Bisichi	52	6	34	3
Ex-Lands Nigeria	40	—	—	—
Geevor	60	—	60	—
Gold and Base Metal	41	—	37	1
Jantar Nigeria	15½	10½	—	—
Jos Tin	17	—	—	—
Kaduna Prospectors	5	—	8	—
Kaduna Syndicate.....	16	—	19	—
Katu Tin.....	13	—	43	—
Keffi Tin	—	—	—	—
London Nigerian Mines ...	—	—	—	—
Mawchi Mines	—	66‡	—	68‡
Naraguta Extended	11	—	—	—
Naraguta Karama	11	—	—	—
Naraguta Tin	—	—	—	—
Renong Consolidated	—	—	—	—
Ribon Valley (Nigeria)	5	—	—	—
Siamese Tin Syndicate	24	—	—	—
South Bukeru.....	—	—	—	—
South Crofty	65	—	67	—
Tavoy Tin	—	—	—	—
Tin Fields of Nigeria.....	—	—	—	—
United Tin Areas of Nigeria	3½	—	—	—

† Wolfram. ‡ Mixed Concs.

SOUTH AFRICAN MINERAL OUTPUT

April, 1958

Gold.....	1,437,640 oz.
Silver	139,410 oz.
Diamonds	361,447 carats.*
Coal	3,339,596 tons.
Copper.....	(*a*) 115 tons in matte and copper-gold concentrates. (*b*) 4,440 tons of 99·40%.
Tin	255 tons concs.
Platinum (concentrates, etc.)	—
Platinum (crude)	—
Asbestos	14,920 tons.
Chrome Ore	64,305 tons.
Manganese Ore	73,549 tons.
Lead Concs.....	— tons.

* Mar., 1958.

IMPORTS OF ORES, METALS, ETC., INTO UNITED KINGDOM

		Apr.	May
Iron Ore	tons	1,046,612	1,313,514
Manganese Ore.....	,,	25,803	32,771
Iron and Steel	,,	76,282	60,064
Iron Pyrites	,,	15,304	26,297
Copper Metal	,,	36,183	40,267
Tin Ore	,,	6,476	6,765
Tin Metal	,,	582	1,429
Lead.....	,,	9,508	12,152
Zinc Ore and Conc.	,,	3,775	—
Zinc	,,	11,464	14,040
Tungsten Ores	,,	822	419
Chrome Ore	,,	11,921	19,261
Bauxite	,,	25,298	28,842
Antimony Ore and Concs.....	,,	333	1,544
Titanium Ore	,,	31,617	12,746
Nickel Ore	,,	2,821	6,466
Tantalite/Columbite	,,	88	19
Sulphur	,,	14,210	37,189
Barytes.....	,,	6,168	3,353
Asbestos	,,	10,818	14,225
Magnesite	,,	1,107	3,258
Mica	,,	313	602
Graphite	,,	730	679
Mineral Phosphates	,,	78,812	92,626
Molybdenum Ore	,,	298	268
Nickel	cwt.	35,189	24,009
Aluminium	,,	174,690	498,872
Mercury.....	lb.	102,651	147,745
Bismuth	,,	101,360	86,201
Cadmium	,,	134,251	149,141
Cobalt and Cobalt Alloys	,,	9,386	128,657
Selenium	,,	6,987	8,375
Petroleum Motor Spirit ...1,000	gals.	51,824	68,290
Crude	,,	760,372	722,662

Prices of Chemicals

The figures given below represent the latest available.

		£	s.	d.
Acetic Acid, Glacial	per ton	106	0	0
,, ,, 80% Technical	,,	97	0	0
Alum, Comml.	,,	25	0	0
Aluminium Sulphate.....	,,	16	10	0
Ammonia, Anhydrous	per lb.		2	0
Ammonium Carbonate	per ton	59	0	0
,, Chloride, 98%	,,	26	0	0
,, Phosphate (Mono- and Di-) ...	,,	102	0	0
Antimony Sulphide, golden	per lb.		3	0
Arsenic, White, 99/100%	per ton	47	10	0
Barium Carbonate (native), 94%	,,	Nominal		
,, Chloride	,,	53	0	0
Barytes (Bleached)	,,	20	0	0
Benzole	per gal.		5	2
Bleaching Powder, 36% Cl.	per ton	30	7	6
Borax	,,	44	0	0
Boric Acid, Comml.	,,	75	10	0
Calcium Carbide	,,	40	17	9
,, Chloride, solid, 70/75%	,,	13	5	0
Carbolic Acid, crude 60's	per gal.		8	3
Carbon Bisulphide.....	per ton	62	10	0
Chromic Acid (ton lots)	per lb.		2	2½
Citric Acid	per cwt.	11	0	0
Copper Sulphate	per ton	66	0	0
Creosote Oil (f.o.r. in Bulk)	per gal.		1	2
Cresylic Acid, 97–98%	,,		6	6
Hydrochloric Acid 28° Tw.	per carboy		13	0
Hydrofluoric Acid, 59/60%	per lb.		1	1
Iron Sulphate.....	per ton	3	17	6
Lead, Acetate, white	,,	124	0	0
,, Nitrate	,,	116	0	0
,, Oxide, Litharge	,,	106	5	0
,, Red.....	,,	104	5	0
,, White	,,	116	0	0
Lime, Acetate, brown	,,	40	0	0
Magnesite, Calcined	,,	20	0	0
,, Raw	,,	9	0	0
Magnesium Chloride, ex W'h'se	,,	16	0	0
,, Sulphate, Comml.	,,	15	10	0
Methylated Spirit, Industrial, 66 O.P.....	per gal.		6	3
Nitric Acid, 80° Tw.	per ton	37	10	0
Oxalic Acid	,,	129	0	0
Phosphoric Acid (S.G. 1·750)	per lb.		1	4
Pine Oil.....	per ton	Nominal		
Potassium Bichromate	per lb.		1	2½
,, Carbonate (hydrated)	per ton	74	10	0
,, Chloride, 96%	,,	21	0	0
,, Iodide	per lb.		9	0
,, Amyl Xanthate	,,	Nominal		
,, Ethyl Xanthate.....	,,	Nominal		
,, Hydrate (Caustic) solid	per ton	118	0	0
,, Nitrate	per cwt.	4	1	0
,, Permanganate	per ton	193	10	0
,, Sulphate, 48%	,,	22	1	0
Sodium Acetate	,,	99	0	0
,, Arsenate, 58–60%	,,	Nominal		
,, Bicarbonate.....	,,	15	0	0
,, Bichromate	per lb.		1	0
,, Carbonate (crystals)	per ton	Nominal		
,, ,, (Soda Ash) 58%	,,	13	5	0
,, Chlorate	,,	92	0	0
,, Cyanide 100% NaAN basis	per cwt.	6	6	6
,, Hydrate, 76/77%, solid	per ton	33	0	0
,, Hyposulphite, Comml.	,,	32	15	0
,, Nitrate, Comml.	,,	29	10	0
,, Phosphate (Dibasic)	,,	40	10	0
,, Prussiate.....	per lb.		1	0½
,, Silicate	per ton	11	0	0
,, Sulphate (Glauber's Salt).....	,,	9	15	0
,, ,, (Salt-Cake).....	,,	8	0	0
,, Sulphide, flakes, 60/62%	,,	37	2	6
,, Sulphite, Comml.	,,	27	10	0
Sulphur, American, Rock (Truckload).....	,,	17	0	0
,, Ground, Crude	,,	19	0	0
Sulphuric Acid, 168° Tw.	,,	10	15	0
,, ,, free from Arsenic, 140° Tw.	,,	8	3	0
Superphosphate of Lime, 18% P_2O_5	,,	14	18	6
Tin Oxide	,,	Nominal		
Titanium Oxide, Rutile	,,	172	0	0
,, White, 25%	,,	85	0	0
Zinc Chloride.....	,,	95	0	0
,, Dust, 95/97% (4-ton lots)	,,	104	0	0
,, Oxide	,,	88	10	0
,, Sulphate	,,	32	0	0

Share Quotations

Shares of £1 par value except where otherwise stated.

GOLD AND SILVER:	June 9, 1958 £ s. d.	July 10, 1958 £ s. d.
SOUTH AFRICA:		
Blinkpoort (5s.)	2 3 3	2 8 0
Blyvooruitzicht (2s. 6d.)	1 2 3	1 2 6
Brakpan (5s.)	5 6	4 9
Buffelsfontein (10s.)	1 17 9	1 18 6
City Deep	14 6	14 0
Consolidated Main Reef	16 3	15 0
Crown Mines (10s.)	1 4 6	1 3 9
Daggafontein (5s.)	1 9 3	1 9 9
Dominion Reefs (Ord. 5s.)	12 6	11 9
Doornfontein (10s.)	1 7 0	1 6 3
Durban Roodepoort Deep (10s.)	1 8 9	1 9 3
East Champ d'Or (2s. 6d.)	2 0	1 9
East Daggafontein (10s.)	8 6	8 6
East Geduld (4s.)	1 5 6	1 5 3
East Rand Proprietary (10s.)	2 1 6	1 18 9
Freddies Consol.	2 6	2 9
Free State Dev. (5s.)	4 0	5 6
Free State Geduld (5s.)	4 3 9	4 12 0
Free State Saaiplaas (10s.)	11 3	13 3
Geduld	3 4 9	3 2 6
Government Gold Mining Areas (5s.)	4 0	4 0
Grootvlei (5s.)	15 9	15 6
Harmony (5s.)	1 15 6	1 18 9
Hartebeestfontein (10s.)	3 3 0	3 5 3
Libanon (10s.)	8 3	7 9
Loraine (10s.)	2 3	2 9
Luipaards Vlei (2s.)	10 3	9 9
Marievale (10s.)	18 9	19 6
Merriespruit (5s.)	4 0	4 0
Modderfontein B (3d.)	2 9	3 0
Modderfontein East	15 0	14 0
New Kleinfontein	4 9	4 0
New Pioneer (5s.)	1 14 0	1 15 3
New State Areas (10s.)	2 0	2 0
President Brand (5s.)	2 11 6	2 13 3
President Steyn (5s.)	1 6 3	1 9 3
Rand Leases (10s.)	4 6	4 0
Randfontein	1 4 3	1 5 0
Riebeeck (10s.)	13 0	16 0
Rietfontein (5s.)	8 9	8 0
Robinson Deep (7s. 6d.)	10 0	10 0
Rose Deep (6s. 6d.)	13 6	10 3
St. Helena (10s.)	2 2 0	2 2 9
Simmer and Jack (2s. 6d.)	4 3	4 0
South African Land (3s. 6d.)	1 2 0	1 1 0
Springs (5s.)	2 0	1 9
Stilfontein (5s.)	2 1 6	2 0 3
Sub Nigel (10s.)	13 6	13 6
Vaal Reefs (5s.)	1 17 3	1 16 3
Van Dyk (7s. 9d.)	4 6	3 3
Ventersspost (10s.)	14 9	14 0
Virginia (5s.)	8 0	8 0
Vlakfontein (10s.)	16 9	16 0
Vogelstruisbult (10s.)	9 0	8 0
Welkom (5s.)	13 9	15 3
West Driefontein (10s.)	4 17 6	5 3 9
West Rand Consolidated (10s.)	1 5 0	1 5 6
West Witwatersrand Areas (2s. 6d.)	2 3 9	2 4 6
Western Holdings (5s.)	4 13 0	5 0 0
Western Reefs (5s.)	1 6 0	1 5 9
Winkelhaak (10s.)	17 0	17 0
Witwatersrand Nigel (2s. 6d.)	1 6	1 6
RHODESIA:		
Cam and Motor (2s. 6d.)	8 6	8 3
Chicago-Gaika (10s.)	15 3	15 0
Coronation (2s. 6d.)	3 6	3 9
Falcon (5s.)	7 0	7 6
Globe and Phœnix (5s.)	1 6 6	1 8 3
Motapa (5s.)	6	7
GOLD COAST:		
Amalgamated Banket (3s.)	1 3	1 0
Ariston Gold (2s. 6d.)	4 6	4 0
Ashanti Goldfields (4s.)	15 9	15 6
Bibiani (4s.)	2 3	2 1
Bremang Gold Dredging (5s)	1 6	1 6
Ghana Main Reef (5s.)	2 0	1 9
Konongo (2s.)	1 7	1 6
Kwahu (2s.)	3 0	3 0
Taquah and Abosso (3s.)	—	—
Western Selection (5s.)	4 9	4 3
AUSTRALASIA:		
Gold Fields Aust. Dev. (3s.), W.A.	1 6	1 6
Gold Mines of Kalgoorlie (10s.)	7 9	9 3
Great Boulder Propriet'y (2s.), W.A.	12 0	12 3
Lake View and Star (4s.), W.A.	1 2 3	1 2 6
London-Australian (2s.)	—	9
Mount Morgan (10s.), Q.	7 3	8 9
New Guinea Gold (4s. 3d.)	1 3	1 3
North Kalgurli (1912) (2s.), W.A.	7 6	7 6
Sons of Gwalia (10s.), W.A.	2 3	2 3
Western Mining (5s.), W.A.	8 3	8 6

	June 9, 1958 £ s. d.	July 10, 1958 £ s. d.
MISCELLANEOUS:		
Fresnillo ($1·00)	2 3 9	2 0 0
Kentan Gold Areas (1s.), E. Africa	2	3
St. John d'el Rey, Brazil	3 1 3	2 12 3
Yukon Consolidated ($1)	5 3	5 0
COPPER:		
Bancroft Mines (5s.), N. Rhodesia	15 9	16 9
Esperanza (2s. 6d.), Cyprus	1 2	1 6
Indian (2s.)	3 6	3 9
Magundi (5s.)	2 6	2 6
Messina (5s.), Transvaal	4 6 3	4 14 3
Mount Lyell, Tasmania	16 0	16 3
Nchanga Consolidated, N. Rhodesia	10 1 3	10 0 0
Rhokana Corporation, N. Rhodesia	27 0 0	26 5 0
Roan Antelope (5s.), N. Rhodesia	8 3	8 0
Tanganyika Concessions (10s.)	3 1 0	2 19 6
LEAD-ZINC:		
Broken Hill South (5s.), N.S.W.	2 7 6	2 6 3
Burma Mines (3s. 6d.)	1 6	1 9
Consol. Zinc Corp. Ord.	2 4 3	2 7 6
Electrolytic Zinc, Tasmania (Pref. 5s.)	2 12 6	2 12 6
Lake George (5s.), N.S.W.	4 0	4 9
Mount Isa, Queensland (5s. Aust.)	1 2 0	1 2 9
New Broken Hill (5s.), N.S.W.	1 11 6	1 12 9
North Broken Hill (5s.), N.S.W	3 13 6	3 14 6
Rhodesia Broken Hill (5s)	8 0	7 9
San Francisco (10s.), Mexico	15 3	18 0
TIN:		
Amalgamated Tin (5s.), Nigeria	5 0	5 0
Ampat (4s.), Malaya	6 3	6 6
Ayer Hitam (5s.), Malaya	1 2 6	1 3 6
Beralt (5s.), Portugal	1 5 0	1 7 6
Bisichi (2s. 6d.), Nigeria	3 3	2 9
Ex-Lands (2s.), Nigeria	1 9	1 9
Geevor (5s.), Cornwall	14 6	14 9
Gold Base Metals (2s. 6d.), Nigeria	9	9
Hongkong (5s.), Malaya	4 6	4 3
Jantar Nigeria (3s.)	2 0	2 0
Kaduna Syndicate (2s.), Nigeria	2 0	2 0
Kamunting (5s.), Malaya	8 0	8 0
Kramat Pulai (3d.), Malaya	2 9	2 9
Malayan Tin Dredging (5s.)	10 9	10 6
Mawchi Mines (4s.), Burma	1 9	1 6
Naraguta Extended (5s.), Nigeria	9	9
Pahang (5s.), Malaya	4 3	4 0
Siamese Synd. (5s.)	7 0	6 3
South Crofty (5s.), Cornwall	4 3	4 3
Southern Kinta (5s.), Malaya	16 0	16 3
Southern Malayan (5s.)	8 3	8 0
Southern Tronoh (5s.), Malaya	7 6	8 0
Sungei Besi (4s.), Malaya	12 9	13 0
Sungei Kinta, Malaya	15 3	14 0
Tronoh (5s.), Malaya	9 9	10 3
United Tin Areas (2s. 6d.), Nigeria	5	4½
DIAMONDS:		
Anglo American Investment	8 13 0	8 15 0
Consol African Selection Trust (5s.)	13 0	14 3
Consolidated of S.W.A. Pref (10s.)	11 0	10 6
De Beers Deferred (5s.)	5 1 0	5 3 0
FINANCE, ETC.		
African & European (10s.)	3 1 3	3 5 6
Anglo American Corporation (10s.)	7 0 0	7 6 3
Anglo-French Exploration	1 3 6	1 3 6
Anglo Transvaal 'A' (5s.)	1 13 3	1 12 3
British South Africa (15s.)	3 0 0	3 4 0
British Tin Investment (10s.)	15 6	15 9
Broken Hill Proprietary	1 15 9	1 17 0
Camp Bird (10s.)	8 0	11 3
Central Mining	3 1 9	3 4 0
Central Provinces Manganese (10s.)	1 7 0	1 8 9
Consolidated Gold Fields	2 14 0	2 15 0
Consolidated Mines Selection (10s.)	1 13 3	1 15 0
East Rand Consolidated (5s.)	1 6	1 3
Free State Development (5s.)	4 0	5 6
General Exploration O.F.S. (2s. 6d.)	3 0	3 9
General Mining and Finance	4 13 0	4 15 0
H.E. Proprietary (5s.)	7 6	8 3
Johannesburg Consolidated	2 8 0	2 11 0
London & Rhod. M. & L. (5s.)	7 3	7 9
London Tin Corporation (4s.)	7 3	7 0
Lydenburg Est. (5s.)	12 6	14 0
Marsman Investments (10s.)	2 0	2 3
National Mining	1 9	1 6
Rand Mines (5s.)	4 0 0	3 17 0
Rand Selection (5s.)	1 19 0	1 19 3
Rhodesian Anglo American (10s.)	3 10 0	3 8 6
Rhodesian Corporation (5s.)	3 9	3 9
Rhodesian Selection Trust (5s.)	16 6	15 0
Rio Tinto (10s.)	2 19 3	2 18 3
Selection Trust (10s.)	3 15 9	3 18 9
South West Africa Co. (3s. 4d.)	11 3	16 3
Union Corporation (2s. 6d.)	2 0 6	2 3 0
West Rand Inv. Trust (10s.)	2 9 3	2 8 3
Zambesia Exploring	2 5 0	2 3 6

THE MINING DIGEST

A RECORD OF PROGRESS IN MINING, METALLURGY, AND GEOLOGY

In this section abstracts of important articles and papers appearing in technical journals and proceedings of societies are given, together with brief records of other articles and papers; also notices of new books and pamphlets and lists of patents on mining and metallurgical subjects.

Australian Mineral Industry

An article by Dr. J. A. Dunn in *The Australian Mineral Industry, Quarterly Review*, Vol. 10, No. 4, is entitled "Australian Minerals and Metals: 1957 and Current Review." He says that in Australia despite the considerable fall in prices of such important metals as lead, zinc, and copper mineral output continued at a high level during 1957. Indeed of the more important minerals only tungsten and tin showed noticeable falls in production. However, the drastic falls in prices have greatly reduced the revenues of the larger companies and, as much development was expected to be financed from revenue, the completion of several development programmes will be delayed.

Prospecting continued in many parts of Australia. The Commonwealth Aluminium Corporation and Aluminium Laboratories, Ltd., were prospecting bauxite deposits on Cape York Peninsula. Rio Tinto Exploration, Ltd., Reynolds Pacific Mines Pty., Ltd., and Aluminium Laboratories, Ltd., secured permits to prospect for bauxite in Arnhem Land, Northern Territory. At Mt. Lyell the penetration by bore-holes of another copper ore-body was recorded. Also on the West Coast of Tasmania, in the Long Plains district, geophysical work by the Bureau of Mineral Resources disclosed an anomaly outside the reserve of known iron-ore deposits and this is now being prospected. In northern Western Australia several new manganese deposits have been found. During the year large-scale production of ilmenite commenced in Western Australia. Two important new base-metal mines came into production—the Ravenshoe tin dredge on Battle Creek, northern Queensland, and the Ravensthorpe copper mine in Western Australia.

During the year the most important new plant to commence operating was the tinplate mill at Port Kembla. The iron-ore sintering plant also at Port Kembla was completed early in the year. Construction of the new copper refinery at Townsville is well ahead and the uranium plant at Mary Kathleen, Queensland, is expected to be ready for treatment in mid-1958. During 1957 three announcements were of great importance to the lead-zinc industry: The decision to increase electrolytic zinc production at Risdon, the decision to increase lead-smelting capacity at Port Pirie, and the proposal to erect a zinc smelter (47,000 tons annual capacity) and by-product acid plant at Cockle Creek, N.S.W. The recent decision by B.H.P. to erect steel furnaces and rolling mills at Whyalla, South Australia, at a cost of £30,000,000 is the most important mineral industry announcement so far in 1958.

The increase in the amount of subsidy on gold production payable by the Federal Government under the Gold Mining Industry Assistance Act, will further assist the gold producers. The Sulphuric Acid Bounty Act, 1957, was extended to include acid produced from prescribed minerals irrespective of end use of the acid; the former £600,000 annual bounty ceiling was also removed and the bounty was extended to acid produced from gases from the sintering of lead concentrates. Towards the end of the year the Commonwealth Government passed legislation to encourage the search for oil by means of a subsidy on a £ for £ basis up to £500,000 in a year on the cost of drilling holes in approved areas to obtain stratigraphic information. The Tariff Board examined the position of the copper producers; the Government's decision to assist the copper industry by tariff and subsidy was announced in May, 1958. The Board also held an inquiry on an application by the Central Australian Mica Miners' Association for assistance in the production of mica. The Atomic Energy Commission notified that as from June 30, 1957, export of monazite was prohibited, but the Commission would negotiate the purchase of output by existing producers; the object is to assure possible future domestic thorium requirements.

The total value of the primary products of the mineral industry has yet to be assessed, but because of the lower prices for lead, zinc, and copper the total is likely to be lower than that of 1956 (£214,500,000) and probably about £210,000,000.

Mineral exports excluding gold showed little change, decreased average prices for lead, zinc, and rutile being compensated by greater shipments. Decreased values for silver and tungsten were adequately balanced by increased exports of asbestos, coal, and manganese.

Gold

During 1957 gold production recovered somewhat from the decline of the two previous years to 1,083,789 oz. (1,029,821 oz. in 1956). This increase was made despite the rising tendency of costs and can be attributed to the subsidy provided to the industry under the Assistance to Gold Mining Act and to further emphasis on efficiency in part following rationalization of company organization. The subsidy was increased to a maximum of £2 15s. per oz. under the formula and to £2 per oz. to smaller producers. The total subsidies paid under the Act during the year were £588,512.

The main increase in output was in Western Australia but there was a useful increase in Queensland and Victoria. To date in 1958 it would appear that gold production has been well maintained and there is no reason to presume that the total this year will be less than in 1957.

Overseas sales were made by the Gold Producers' Association up to September, but thereafter such sales ceased as sterling strengthened against the

dollar. The total sales by the Association over the year were 687,115·30 oz. yielding an average premium of 7·64d. per oz. after deducting administrative charges. Sales averaged $34·94687 per oz. or £15 13s. 2·4d.

Lead

Production of lead in concentrates was 332,470 tons (299,485 tons in 1956) continuing the series of record annual totals since 1954 and placing Australia as the world's leading lead producer. Smelter production of primary refined lead was 192,363 tons and lead bullion at Mt. Isa was a record at 46,891 tons lead content. Domestic sales improved to 39,067 tons. Exports increased to 160,588 tons of pig lead, 47,618 tons of lead bullion, and 70,736 tons of lead in all concentrates.

The increase in production came from the leading mines and was in part a consequence of higher tonnage per employee. With the sharp fall in price from mid-year practically all the smaller mines had closed down by early 1958. At Broken Hill a decision was made early in 1958 to cut one working day per fortnight, but this may not mean a commensurate reduction in overall output. However, it is unlikely that the total Australian production over 1958 will reach the 1957 record.

The 1957 picture of the lead market illustrates clearly that no matter what Government actions may be taken to support prices the relation of production to real consumption ultimately becomes the sole deciding factor. Indeed price support policies which encourage normally uneconomic production to a point where total production capacity is considerably above real demand may lead eventually to a more severe collapse of prices than would otherwise have occurred. Many would like to see wide price fluctuations in metals smoothed out; the difficulty down the years has been to find a workable and equitable scheme.

The mining community has the satisfaction, however, of anticipating that the exploration and development undertaken during the period of high prices will become significant when consumption again increases towards production capacity, possibly over the next two or three years. In the meantime adjustment can only come from the cessation of production at more marginal mines and by cut-backs by the larger profitable producers.

Zinc

Production of zinc in concentrates reached the high figure of 291,538 tons in 1957 (278,082 tons in 1956). Refined zinc production was 110,370 tons, an increase of some 7,000 tons made possible by improved power availability. Domestic sales at 79,045 tons were higher than in 1956 by over 9,000 tons. Exports of refined zinc were 37,092 tons and of concentrates 144,000 tons recoverable metal content. Since the end of the year stocks of concentrates at mines have tended to increase.

During 1958 actual production of zinc in concentrates may not fall to any appreciable extent, but exports will fall away considerably. For the present the Broken Hill-U.K. pipeline is overfull and any shipments would be dependent on Avonmouth stocks, although occasional dispatches to Japan may be expected according to the shipping position.

Copper

Mine production of copper rose further in 1957 to 56,613 tons (53,706 tons in 1956); blister copper was 50,881 tons and refined copper 32,892 tons. Consumption continued below 40,000 tons of primary copper. Exports of blister were 19,079 tons and of concentrates 16,067 tons. Imports of refined copper were 4,251 tons. These continue to be essential until domestic refining capacity expands sufficiently to take care of local requirements.

Ravensthorpe Copper Mines N.L., Western Australia, came into activity in a small way initially treating dump material. Subsequent to production increases at Mt. Isa and Peko in recent months, further expansion programmes will be delayed. When the Townsville refinery is completed during the year ahead part of Australian refinery production will need to find a market overseas, but in the meantime until prices recover no further increase in mine production may be expected.

Tin

Production of tin in concentrates during 1957 was only 1,938 tons, some 140 tons below the previous year's production. Although the Ravenshoe tin dredge at Battle Creek, northern Queensland, commenced operations in August, small tin producers have left some of the depleted fields, particularly in Tasmania.

Tin smelter production was 1,806 tons. Consumption of tin which had been at the rate of 2,400 tons to 2,500 tons annually, was increased with the opening of the tinplate works at Port Kembla and is now at the rate of about 3,500 tons; actual consumption in 1957 was about 2,650 tons. Imports have necessarily increased and were 1,218 tons in 1957.

The price paid for tin concentrates in Australia is based upon the Singapore price and in the latter part of 1957 and early 1958 the Singapore price was at a level considerably below that of the London Metal Exchange spot price, which was maintained at or above £730 (stg.) by the activities of the International Tin Agreement.

Aluminium

Production of aluminium at Bell Bay has not yet reached capacity but was 10,624 tons in 1957 compared with 9,143 tons in the previous year. Ingot and wirebars were produced and in the latter half of the year extrusion billets were produced in virgin and alloy metal. Some experimental casting alloys were cast at the end of the year. Excess stock at the smelter early in the year compelled the temporary export of some locally produced aluminium. Imports of refinery shapes, mainly from Canada, were 8,374 tons, considerably less than in recent years. There are some imports of fabricated and semi-fabricated forms, but rolled and extruded aluminium plant capacity has increased and total consumption of primary metal may be expected to rise above 22,000 tons. Ample power is now available at Bell Bay and with construction of new furnaces capacity production may be reached.

The price of Bell Bay aluminium 1–20K ingots was reduced on October 1 from £277½ per ton to £271 per ton.

Plans for the development of Queensland and Northern Territory bauxites may be expected to proceed; they are of course long-term plans related to the markets of the future. As the writer outlined in the November, 1957, issue of this Quarterly the likely market for Australian alumina

would appear to be the Pacific coast of North America. The finding of large low-grade deposits of bauxite in Hawaii has since been announced. They occur within an area of 300 sq. miles on the island of Hawaii and 30 sq. miles each on Maui and Kauai. The average thickness is 15 ft. to 20 ft. with little or no overburden. They have a high water content *in situ*; on Hawaii the grade is even lower than on the other two islands. The possibilities of beneficiation are being investigated. Economic grade bauxite if available from this source could prove to be a competitor on the U.S. Pacific coast to Australian production.

Rutile, Zircon, and Ilmenite

Production of rutile was 128,906 tons in 1957 compared with 96,816 tons in 1956. Exports were 119,052 tons.

Production was well below the total of plant capacity, which encouraged by U.S., U.K., and Continental over-buying in 1955–56 had been expanded considerably during the year to well above that justified by real consumption. The position of over-supply was further aggravated in mid-1957 by a cut-back in U.S. defence requirements of titanium metal. Producers in Queensland and New South Wales are having marketing difficulties and several plants have closed indefinitely.

The price of spot rutile fell sharply during the year and spot sales became rare even at £35 a ton f.o.b. by the end of the year. There is no sign of any improvement in the rutile market during 1958 and production during the current year is likely to revert to the 1956 level.

Production of zircon increased to 88,980 tons compared with 72,458 tons in 1956; exports were 85,254 tons. As a position of over-supply developed the price weakened from £16 to £18 per ton f.o.b. early in the year to £10 to £12 per ton in the last quarter. To meet increasing competition producers are endeavouring to improve further the grade of their product. As with rutile there is little prospect of recovery in 1958.

Two companies were producing ilmenite in Western Australia during the year and total shipments were 70,029 tons. Part of this went to the titanium dioxide plant at Burnie, Tasmania, and the remainder was exported. The average f.o.b. price latterly has been about £6 a ton. Additional plant may come into production during 1958 in Western Australia but an increasingly competitive market must be expected for a time. Although world production of titanium white is increasing new ilmenite deposits in other countries are being opened up and world production capacity of ilmenite is increasing rapidly. Recently lowered freight rates are a help to Australian producers.

Tungsten

During 1957 total tungsten concentrate (65% WO_3) production was 2,148 tons, rather lower than in the previous year. Prices in London showed a continued downtrend from 222·5s. a unit at the beginning of the year to 96·3s. at the end. Small producers in Queensland, Tasmania, and Northern Territory ceased operations; Moina Tungsten Tin N.L., Tasmania, closed down early in the year and the Pioneer mine, Hatches Creek, Northern Territory, was placed on a care and maintenance basis in the latter part of the year. King Island Scheelite (1947), Ltd., and Aberfoyle Tin N.L. and Storeys Creek N.L. became virtually the only producers of scheelite and wolfram respectively. The remaining long-term contract of King Island Scheelite (1947) N.L. with the U.S. terminated in April, 1958, and the whole of that company's output will need to find a place on the open market—part is likely to be stockpiled for the present.

No worthwhile recovery in the tungsten market seems likely during the remainder of 1958; considerable tonnages of Korean scheelite and Bolivian wolfram continue to appear on the market at low prices.

Iron and Steel

Domestic iron-ore production was 3,800,000 tons during 1957 and in addition 200,000 tons were imported from New Caledonia. Extensive prospecting for iron-ore deposits continued in northern Queensland by Broken Hill Pty. Co., Ltd. Following geophysical prospecting by the Bureau of Mineral Resources of iron-ore deposits in the Natone and Long Plains districts, Tasmania, Rio Tinto Australia Exploration, Ltd., is diamond drilling the area jointly with the State Department of Mines.

Production of iron and steel increased further to 2,217,706 tons of pig iron and 3,055,024 tons ingot steel. The most important new development during the year was the opening of the hot-dipped tinplate plant at Port Kembla in August. Other important features were the opening in January of the 750,000-ton capacity plant for sintering powder ore and the virtual completion of the slabbing mill at Port Kembla. The skelp mill at Newcastle was completed in 1958.

The price of foundry pig and basic steel products remained unchanged in Australia during the year in contrast to a rise in price in the U.K. in mid-1957. However, it is interesting to note that for the first time since 1939 the U.K. price of iron and steel was lowered in April, 1958 by 1% to 3%.

Coal

Black coal production in 1957 was 19,798,998 tons, about 500,000 tons higher than in 1956 and exceeding the previous record figure established in 1954. The improvement was due to higher consumption in the iron and steel industry and to greatly increased exports which reached the record figure of 759,095 tons. Stocks which were heavy were reduced to some extent. With further increase in requirements for iron and steel production and exports production in 1958 should exceed 20,000,000 tons.

Output of brown coal in Victoria during the year was 10,740,989 tons, again a record. The next major step-up in production will be when the two new briquette factories now under construction at Morwell are completed. Their combined capacities will be 1,500,000 tons of briquettes per year to be used for power station fuel and as raw material for brown coal gasification and to provide part of Victoria's other solid fuel usage. Further extensions to Yallourn power station will add to brown coal requirements later.

Uranium

The search for uranium continued in 1957 but less actively than in previous years. Early in the year following a scintillographic survey by the Bureau of Mineral Resources on the Queensland–Northern Territory border, north-west of Mt. Isa, a type of uranium mineralization new to Australia was found in the Westmoreland conglomerates.

The plant at the Mary Kathleen mine is approaching completion and will bring the number of Australian uranium treatment plants to three, with a total uranium oxide production of about 1,000 tons annually. The gold treatment plant of Northern Hercules N.L. at Pine Creek is to be converted to treat uranium ore from the South Alligator River.

Oil Exploration

The search for oil continued both by the Commonwealth Government and by companies but total footage drilled was less than in 1956. The long-range programmes of oil exploration companies will be assisted to some extent by the £ for £ subsidy on stratigraphic drilling. Exploration has been in all States except Tasmania.

Uranium in Canada

In the *Canadian Mining and Metallurgical Bulletin* for May there is a paper " On the Distribution of Canadian Uranium Occurrences," from which the following extracts are taken. The author says that prospecting for uranium in Canada during the past 13 years has revealed many important deposits and thousands of occurrences. More information is available for the distribution of minor uranium occurrences than for those of most other metals, as a result of regulations that require reporting of discoveries and of attention devoted to studying their positions and geological settings. Knowledge of the subject is far from complete, for many areas have not been prospected exhaustively and satisfactory solutions are not yet apparent for many problems regarding the distribution as now known.

The paper is in two parts, the first being an objective description of the pattern of reported occurrences, most of which have been verified. In this section the distribution in general is discussed first and afterwards the distribution of the principal types is described. The remainder of the paper is devoted to an outline of possible explanations, including a brief review of the subject of metallogenetic provinces in general.

The fairly complete segregation, within the Shield, of discoveries of the three principal types is not surprising, in view of the differences in their modes of origin. This segregation seems related largely to the subject of " provinces " discussed later, but it is desirable to mention the following points beforehand.

Deposits of the " vein " type have been found principally in strata classed as Proterozoic, which have been folded and faulted. The conglomeratic deposits of Blind River have also been found in one of these areas. These belts of strata and their associated faults usually strike north-east. Older Precambrian rocks are also exposed in some of these belts and some of the veins occur in them but are considered to be contemporaneous with the younger veins.

The distribution of discoveries of the conglomeratic type cannot yet be explained fully because of uncertainty regarding the origin of the deposits. The ores may have resulted entirely from erosion of rocks relatively high in uranium and from localization of detrital sediments. If so other places that fulfil this condition may be found in the Shield or even in other regions, but if the ores are partly a result of subsequent alteration or deposition their position may berel ated to the general belt of epigenetic gold and base-metal deposits extending from Lake Huron to the Chibougamau area.

The abundance and wide distribution of the pegmatitic type seems explainable by the facts that pegmatites and related deposits are common where granitic rocks have been eroded sufficiently to expose them, that these conditions prevail in many parts of the Shield, and that such deposits commonly contain accessory amounts of high-temperature uranium minerals. The fairly complete segregation of pegmatite and vein types is reasonable, because all uranium available may have gone into pegmatites in some areas and if both pegmatites and veins were deposited in other areas most of the veins would probably be destroyed if erosion reached pegmatitic levels. However, some overlapping of contemporaneous deposits could occur and both types could readily be present in the same area if pegmatites were formed there at a much earlier time.

Uranium deposits resemble those of other metals in a tendency to be most abundant in " metallogenetic provinces " which may or may not correspond to geological or petrographic provinces containing distinctive kinds or ages of rocks or structures. Metallogenetic provinces may be characterized by only one metal or class of deposit but more usually they contain a distinctive group of metals or classes of deposits. Although the existence of such provinces is accepted widely the reasons for them are uncertain and have been the subject of many theories.

Data on the uranium content of rocks in areas containing uranium deposits are scanty because prospectors found deposits in such numbers that the relatively few geologists available were soon involved in other tasks. The rocks of many areas show abnormally high radioactive backgrounds, but few analyses are available to indicate the extent to which this is caused by uranium, thorium, or potassium. Because of the size of the Shield it will be many years before sufficient data of this kind will permit generalizations on the possible relation of metallogenetic provinces to trace amounts of metals in rocks. Studies of sample areas would be a desirable preliminary step.

Evidence for relationship between Canadian uranium deposits and kinds of igneous rocks is also scarce. It has been suggested that uranium deposits in the United States are commonly affiliated with rocks rich in alkalis. Some corroboration for this is evident in connexion with certain Canadian pyrochlore occurrences. Several of the uraninite-uranothorite pegmatites near Bancroft occur in areas containing nepheline syenite but no direct relationship is apparent ; however, the pegmatites themselves are rich in albite. Direct genetic relationships have not been established for Canadian

uranium deposits of vein type. However, many such deposits at Beaverlodge are associated with a form of wall-rock alteration rich in albite.

Summary

Uranium in amounts of 0·05% or more has been found at about 1,500 properties containing a total of roughly 10,000 small mineral occurrences or larger deposits. Most of these are in the Canadian Shield where the three main types (conglomeratic, vein, and pegmatitic) are in fairly distinct areas. Although prospecting has not been sufficient to suggest that these are the only areas where uranium may be found, and although much remains to be learned regarding the origin of the deposits and the reasons for their distribution, these areas offer obvious places in which to begin any further prospecting that may be desirable for their respective kinds of deposits and the continuations of these areas and other places in which the geology is more or less similar provide scope for more venturesome prospecting. The main generalizations that the writer draws from a review of the present knowledge are :—

Uranium occurs in Canada in much the same broad regions as other metals. However, although uranium is commonly accompanied by copper, cobalt, nickel, silver, iron, and other metals, commercial uranium deposits have not been found close to the principal deposits of these metals. This is believed to be largely because of differences in the chemical behaviour of uranium in the case of vein deposits and because pegmatite deposits seldom contain metals in large amounts.

The distribution of known occurrences provides data from which metallogenetic provinces for uranium can be outlined fairly completely in some instances and partly in others. The writer considers it reasonable to make further distinctions into conglomeratic, pitchblende, and pegmatitic provinces, in which deposits of these general kinds are exclusively present or are the prevailing type. These provinces correspond to a large degree with geological provinces and sub-provinces. The writer believes that many uranium provinces can be explained by geological events and that original inhomogeneity or other causes should not be invoked except as last resorts. However, some barren areas and associations, such as the concentration of complex minerals in the Grenville, may prove to be best explained by inhomogeneity. The pattern in the Shield seems largely explainable on the basis that pegmatite occurrences are found mainly in the deeply-eroded remnants of primary mountains and vein and conglomeratic occurrences mainly in belts of secondary orogeny. The favourability of the latter may be due only to associated faulting and fracturing associated with veins, to deposition of uranium-bearing conglomerate, and to less severe erosion of secondary folded belts with resulting preservation of vein and conglomeratic deposits. Further favourability would exist if uranium was transported from a primary to a secondary belt by erosion and sedimentation and later supplied to veins and perhaps to pegmatites by granitization, leaching, or diffusion.

The concentration of discoveries around the margin of the Shield is believed to result largely from the relative accessibility of many such areas. There are, however, geological reasons such as the situation of the Grenville, the location of belts of secondary orogeny represented by the Great Bear, East Arm, Taltson, and Athabaska sub-provinces, and perhaps the effect of parts of the Palaeozoic cover in preventing deep erosion of veins. These reasons, however, do not preclude the possibility of discoveries in other suitable parts of the Shield.

Uranium Treatment Plants in Australia

In the course of the second part of an article on "Ore Dressing Developments in Australia," appearing in the *Chemical Engineering and Mining Review* of Melbourne for April 15, Professor H. H. Dunkin discusses treatment at four uranium plants in the sub-continent. First, he says, improved techniques in the Radium Hill concentrator have led to 4% better uranium recovery. The thickened slime fraction (90% *minus* 200 mesh) of the *minus* 10-mesh product from the heavy-media feed preparation screen was previously fed to a 7 ft. by 6 ft. ball-mill with coarse products from elsewhere in the circuit. Experimental work had indicated the need to expose fresh mineral surfaces in the course of conditioning with flotation reagents. Irregularities in the proportion of slime present in the feed caused serious variations in ball-mill classifier overflow densities with resultant low average grinding efficiencies. Small-scale investigations had suggested that conditioning in an environment of intense agitation was possible. Plant-scale tests led to the exclusion of slime from the ball-mill feed and the adaptation of several flotation cells to provide pre-flotation agitation and attrition for this material. Grinding of the other products improved in efficiency and uniformity and the percentage of *minus* 200-mesh material in the classifier increased from 50 to 60.

Flotation reagents normally used were fuel oil, sulphonated whale oil, linseed fatty acids, and cresylic acid. At the beginning of the year the practice was to add 10 lb. of diesel fuel per ton of flotation feed at the ball-mill with the other reagents. By adding only 8 lb. per ton to the ball-mill and the balance to the tailings pulp from the first half of the flotation circuit and to the froth from the last quarter of the circuit an improvement in the character of the froth was achieved. This made it possible to operate the flotation circuit with a higher circulating load of scavenger concentrate.

More extensive assaying and examination of products assisted in the overall improvement in uranium recovery.

In October, 1954, prospectors employed by United Uranium No Liability found the El Sherana lode in the South Alligator river district, 135 miles S.S.E. of Darwin. Since then the company has been carrying out a programme of drilling and underground development on this and several other discoveries and at the end of 1956 had an ore reserve of 108,179 tons of uranium ore assaying 9·37 lb. U_3O_8 per ton, containing 1,014,091 lb. of

oxide. In 1957 the company drilled the Coronation Hill lode, which at January, 1958, had an ore reserve of over 30,000 tons assaying 4·8 lb. U_3O_8 per ton.

The El Sherana lode, which has an ore reserve of 55,000 tons of 0·5% ore, occurs on a strong shear at the unconformity between steeply dipping lower proterozoic shales and overlying flat upper proterozoic sandstones and volcanic rocks. At its mid-point the lode has a width of 70 ft., but along the shear massive pitchblende occurred in lenses ranging up to 10 ft. in height and depth and a width of 24 in. One of the lenses yielded a piece of pitchblende weighing 1,856 lb., estimated to assay over 66% U_3O_8.

In 1956 the company obtained a contract to supply Combined Development Agency in Washington with a maximum of 200 tons of pitchblende. The first 50 tons, which was hand-sorted from stoping operations and dispatched towards the end of 1956, assayed 65·9% U_3O_8. Following the above shipment the company erected a small gravity concentration mill consisting of a jaw-crusher, crushing rolls, vibrating screen, Bendalari jig, and Wilfley table. The rolls and screen were operated in wet closed circuit and the jig was used as a rough concentrator, the final concentrate being obtained on the Wilfley table. From the plant the company has exported 120 tons of concentrate and has now completed its contract. The pitchblende contained free gold and the average assay of concentrate exported was over 1 oz. per ton. A small amalgamating table was added to the circuit in August, 1957, and from this the mill recovered 160 fine oz. of gold. Power for milling was obtained from one 70-kVA diesel alternator supplemented by one 56-h.p. diesel engine driving the rolls, crusher, and screen. Water was obtained from the nearby South Alligator River. Residues from the milling of El Sherana pitchblende ore, totalling 4,773 tons assaying 0·6% U_3O_8, were transported by road to the Rum Jungle uranium mill. Finally, the Palette pitchblende lode was mined and milled and from this there is on hand approximately 1,200 tons of residues assaying 0·8% U_3O_8.

Together with its neighbour, South Alligator Uranium N. L., which holds the Rockhole leases 3 miles from El Sherana, United Uranium is currently negotiating a contract with the British Atomic Energy Authority to supply uranium oxide from the field over a long-term period.

Good progress was made during 1957 in construction of plant for Mary Kathleen Uranium, Ltd. This field, discovered in 1954, is in rough country half-way between Cloncurry and Mt. Isa and 40 miles from each. Development of the property was undertaken by the Rio Tinto Mining Co. of Australia Pty. Ltd., with capital provided largely by the Rio Tinto parent company and the United Kingdom Atomic Authority. To bring the mine into production £12,000,000 will be needed. Remoteness of the area posed construction and planning problems which have for the most part been related to labour, supplies, and transport. To house the labour force in modern comfort a complete town was built before erection of plant and allied services started. The town was started in 1956 and took a year to complete. It accommodates 1,200 people in 221 units, which are designed to provide maximum comfort under summer conditions. In addition there are a modern cafeteria, community store, swimming pool, tennis courts, sports oval, a wet canteen, an open-air cinema, and a hospital.

One result of this policy is a low labour turnover which has contributed materially to rapid construction progress. Water is supplied from the Corella dam, which was built in 11 months and completed in January, 1957. This is 8 miles from the town and 11 from the plant and has a 3,300,000,000 gallon capacity. Anticipated rate of consumption is 1,250,000 gallons per day. The power station has 5,000 kW capacity provided by diesel-alternator sets.

At the Rum Jungle treatment plant of Territory Enterprises Pty., Ltd., washing of leached pulp by counter-current decantation prior to filtration started in May, 1957, when a 100 ft. diameter rubber-lined thickener was installed. This step increased overall recovery of U_3O_8 by more than 2%. Liquor used for dilution of pulp fed to the thickener is weak filtrate from the subsequent filtration washing stages. Washing of filter cake with water acidified to pH 1·6 with sulphuric acid and repulping of first-stage filter cake with this acidified water also started in May. This prevents the possibility of reprecipitation of uranium in the filter cake. Similar acidified water is also used for forward flushing and back washing of the ion-exchange columns to prevent hydrolysis.

A 3 ft. diameter by 4 ft. diameter filter of monel metal construction with a rubber-lined mild-steel tank has been installed as a first stage product filter. This machine is of the string discharge type and its operation has reduced the chloride content of the uranium product to well below the specified limit of 0·1%. A vibrator is now being used to increase the capacity of product drums. Backwash liquor from the sand pressure clarifiers is now delivered to the C.C.D. system and a spillage recovery pump returns uranium and copper-bearing liquor and pulp lost from the circuit to the 100-ft. thickener. When blinding of filter cloth occurs because of excess flocculant in the pulp the cloth is rejuvenated as follows :—Wash and scrub the cloth with water; rotate the drum in 5% (weight per volume) solution of caustic soda for two hours ; water wash and lightly scrub the cloth ; rotate the drum in a 5% sulphuric acid solution ; water wash and lightly scrub the cloth. By this procedure cloth life has been extended by up to 500%. Cloth and string life have also been extended by the use of rubber-covered grooved rolls instead of the types originally installed. One cloth at present in use has already had a life of 4,500 hours and shows no signs of deterioration.

A sulphur spray nozzle was installed in the sulphur burner of No. 2 acid plant in May. This greatly improved combustion of the dark sulphur being used and eliminated the pool of sulphur which had previously accumulated on the bottom of the burner.

In the pilot plant work has been confined to the development of a process for the treatment of ore from Dyson's. It has been shown that this ore can be treated by C.C.D. and filtration, but the cost is high and alternative methods are being investigated.

In collaboration with the C.S.I.R.O. a sand-slime R.I.P. process has been developed, using cyclones for sand-slime separation at 300 mesh and a jig bed R.I.P. pulse column. Other test work on Dyson's ore involved removal of phosphates from the final product by solvent extraction or by two-stage precipitation using excess ferric iron to form a phosphate complex.

Mining at Bicroft Uranium

(*Concluded from the June issue, p. 378*)

A second sinking programme recently completed has taken the No. 2 main shaft to 1,300 ft. with ten levels, established at 125-ft. vertical intervals, and with two loading pockets established below the third and eighth levels respectively. Eighth levels are therefore available for routine mining. The two bottom levels below the eighth are designed to allow further shaft sinking without interference with production.

The four-compartment No. 2 production shaft is 9 ft. by 25 ft. outside the timber. The compartments are in line and are timbered with 10-in. by 10-in. standard B.C. fir shaft sets at 7-ft. centres. Three compartments are 5 ft. 6 in. by 7 ft. 6 in. inside the timber and are used for the two 6-ton skip-cage combinations and the service cage. The fourth compartment 4 ft. by 7 ft. is a combination manway-counterweight compartment. At present, an average of 8,750 tons of ore and 1,800 tons of development waste are hoisted weekly in 11 working shifts.

Development layout on all levels is essentially the same. There is an 8-ft. by 8-ft. main-haulage drive driven first which also serves as a base for diamond drilling. This is a north-south drive paralleling the main ore zone which lies mainly to the west. These haulage drives are in the neighbourhood of 2,500 ft. long. As diamond drills outline the ore, 8-ft. by 8-ft. cross-cuts are driven to the ore at the appropriate intervals. When the cross-cuts intersect the N.-S.-striking dykes driving is commenced, provided that the dyke is ore bearing. The driving on an ore-bearing dyke being completed, backs are then taken down to a height of some 18 ft. to 20 ft. The whole is mucked out and back timber with chutes at 20-ft. intervals installed. Where very short lengths of ore are encountered a mucking machine draw point is established. This particularly applies to the short high-grade pipe stopes.

The " shrinkage " stoping method is used throughout. The stopes vary in width from 4 ft. to 12 ft. and in length from 30 ft. to 200 ft. The average dip is 45°, *plus* or *minus* 5°. The stopes generally rake up the dip to the north.

Drilling in stopes is done with jackleg machines and stoper or hammer drills. The average tons broken per man shift is 20. Most of the ore is broken by the breasting method. Uppers are used where the stope is of a dip and rake that is suitable to their use. All blasting is done at the end of the shift and is either tape or electric.

The rock in the hanging-wall is of a good competency as regards loose conditions and can generally be held with 5-ft. and 7-ft. rock bolts. The foot-wall however, is of a different nature and tends to slab off in considerable amounts. .To contend with this dilution of the ore two main methods are used. Three-foot rock bolts are installed and, should sloughing still continue, a pillar 8 ft. by 8 ft. is left and the foot-wall slip re-established. (Most dilution is caused by breaking into the footwall slip.)

In a number of flat-lying stopes, in order to keep the drilling face clear, the muck is cast down the incline. The muck in these particular stopes is kept low through frequent extraction. All holes are aimed to cast down the incline and short-period electric caps are used for the blasting. In using this method it is not necessary to use slushers to get the ore to the chutes. When a stope is completed to the level above it is cleaned down, using air and water blowers.

The ore is drawn from the stopes as required, using 40-cu. ft. side-dump cars. A 1½-ton battery locomotive is used to pull six of these cars to the ore pass. Fifteen motors are required for the present scale of operations, including handling of development muck. An ore- and waste-pass system is used and terminates in shaft loading pockets below the third and eighth levels. The ore passes through grizzlies when dumped at each level. There is as yet no underground crusher. However, no major trouble has been experienced in handling the ore through the loading pockets.

In the first ten months of 1957 81% of the mill feed came from stoping operations, 13·5% from development, and 5·5% from the surface stockpile.

Trade Paragraphs

Hunslet Engine Co., Ltd., of Leeds, state that a new company, Hunslet Locomotives Canada, Ltd., has recently been formed with registered offices at Haileybury, Ontario, to improve the after-sales service facilities, hitherto provided from the United Kingdom in conjunction with Lecky Machinery, Ltd., in Eastern Canada and Gordon Russell, Ltd., in Western Canada. The company have locomotives operating in most of the Canadian mining districts.

Glacier Metal Co., Ltd., of Alperton, Wembley, Middx., announce the introduction of three new " dry " bearing materials :—DU, comprising thin steel strip with a porous bronze coating impregnated with a mixture of a fluoro-carbon plastic (P.T.F.E.) and lead. DQ, is a fluoro-carbon (P.T.F.E.) strengthened with special fillers and supplied in bars and tubes. Non-standards or irregularly shaped dry bearings can be machined from this material. DM, a process for applying an adherent layer about 0·0015–0·0025 in. thick of a combination of fluoro-carbon and molybdenum disulphide to the bearing surfaces of parts sent to the company for treatment.

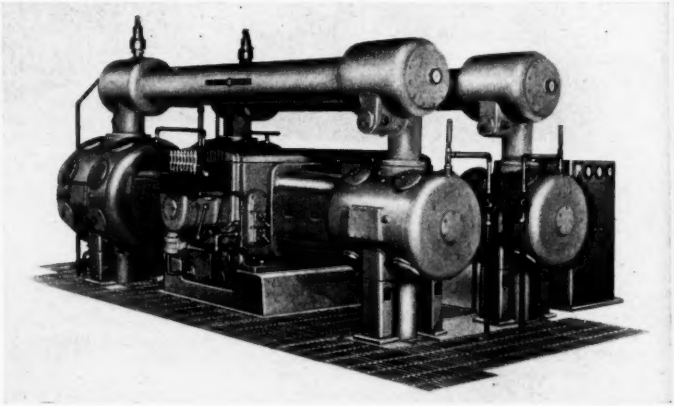
General Electric Co., Ltd., of Magnet House, Kingsway, London, W.C. 2, make available some notes on the largest blade mill ever made at Fraser and Chalmers Engineering Works, Erith. The mill, an illustration of which was reproduced in Ore Dressing Notes in the April issue (page 222), is now in operation at the Nsuta property of African Manganese Co., Ltd. It is used to disintegrate the clay in the crushed ore so that it can be washed out prior to the further concentration of the manganese ore and consists essentially of an 8-ft. dia. rotating cylinder, 24 ft. long, supported on eight rollers. Ore enters through a feed inlet at one end with about an equal weight of water. Rows of blades churn it up in its passage through the mill, so that it is discharged at the other end with the clay disintegrated and the mineral scrubbed clean. Its capacity is 400 tons of *minus* 5-in. ore per hour.

Telektron (Great Britain), Ltd., of 109, Jermyn Street, London, S.W. 1, recently developed a new type of oil mist lubricator incorporating a novel fixing method and having operating characteristics suitable for use in air line systems which are subject to intermittent flow. The lubricator is designed to

give an initial burst of rich oil-air mixture on the first flow through the lubricator and thereafter to reduce the oil content of the mixture and maintain it at a level proportional to the flow. Intended for simple peg mounting from bracket, wall, or cable tray, the distance from the wall is adjustable and this enables a group of lubricators to be mounted close together by allowing the pipes in and out of each lubricator to pass behind the others. They are also suitable for panel mounting and are designed so that the bowls may partially protrude through a cut-out in the panel which allows the filling cap to be exposed. With this arrangement the oil level may be viewed from all angles and the lubricator refilled from outside the panel. As the figure shows they are fitted with transparent bowls of ½ pint capacity, held in position with a clamp ring for which " C " spanners are provided. Alterations to the lubricator performance are made by internal setting of the wick position in the air stream and thus cannot be changed without the use of the special spanner. The wick and peg mounting clamp are adjusted by means of standard allen keys. A legend strip is fitted in each bowl indicating oil type and level. The lubricators are suitable for air pressures up to 150 p.s.i. with flow in either direction and are supplied with ¼ in. b.s.p. ports for use with standard taper or parallel stud couplings.

Consolidated Pneumatic Tool Co., Ltd., of 232, Dawes Road, London, S.W. 6, have produced a new range of heavy-duty compressors embodying balanced opposed design for outputs up to 5,000 c.f.m. at low pressures and smaller outputs up to 3,000 p.s.i. For normal shop use at 100 r.p.m. compressors with outputs from 1,500 c.f.m. to 4,000 c.f.m. can be supplied. Among advantages claimed are high efficiency, small floor area and foundations required, easy accessibility, and reduced vibration. Dynamic balance has been achieved by placing cylinders with equal reciprocating weights on opposite sides of a frame with pistons driven by a double-throw crankshaft and cranks 180° apart. Cranks are arranged in pairs on the shaft and each pair is placed between two main bearings. Construction features include a fully stress relieved crankcase frame, large crankcase access openings with aluminium covers, and individually cast Meehanite cross-head guide housings. The crankshaft is a single fully normalized carbon steel forging carrying webs of thick section, while the precision-ground crank pin journals are of the same diameter as the main shaft. The connecting rods are rifle drilled to permit continuous pressure lubrication and are I section drop forgings proportioned to give a low stressed structure. Bearing shells of the precision insert type are carried at the crank pin end of the rod and the crosshead pin end is fitted with a solid phosphor bronze bushing. Full force-feed lubrication is maintained at a pressure of 40 p.s.i.g. by a rotary-type pump driven from the end of the crankshaft through a flexible coupling and spiral gears. A hand-operated lube oil pump for flooding the bearings before starting up is also provided. A separate mechanical lubrication feeds a controlled oil supply to the cylinder and piston rod packing.

Consolidated Pneumatic Compressor



Mechanical Handling Exhibition

(*Concluded from the June issue, p. 382.*)

Lockers (Engineers), Ltd., of Warrington, in addition to a display of vibrating feeders and screens included on their stand an example of their Waytrol constant-weight feeders fitted with automatic control. By means of this the timer device not only shuts off the machine itself but also adjacent machinery in the process flow should any fault in feeding develop.

Mavor and Coulson, Ltd., of Bridgeton, Glasgow, displayed 12 different sizes and kinds of conveyor-belt idlers. In addition a new small driving gear for belt-conveyors was one of three sizes shown, each of which can be driven by any type of motor or engine. The V-ropes absorb the shock of any sudden heavy load and the second-speed reduction runs in oil, the drives being self-contained and weatherproof. The two larger sizes are widely used on field conveyors.

Merton Engineering Co., Ltd., of Faggs Road, Feltham, Middlesex, included two new models in their display of front-wheel-drive hydraulic overloaders. The FC 60 has a Fordson diesel developing 60 b.h.p. with Brockhouse torque converter transmission giving a 3 : 1 stall ratio and full-power shift-type epicyclic gear train for two forward and one reverse speed. The model F 60 is the same but is equipped with a standard Fordson gearbox (six forward and two reverse speeds).

Mining Engineering Co., Ltd., of Worcester, were featuring rollers and idlers for surface conveyors, attention being concentrated on a unit with direct-delivery drive and a screw-type tension end. It had standard idlers and included a hopper structure with rubber-disc impact idlers.

Mitchell Engineering, Ltd., of 1, Bedford Square, London, W.C. 1, drew attention to their Serpentex conveyor for difficult locations where steep ascents and sharp curves have to be negotiated. It is composed of a series of sections of high-grade rubber connected together by bolts, each section incorporating a number of trough-shaped steel stiffening plates which are bonded to the rubber and maintain the shape of the belt. The pull is taken by a chain connected to the steel plates and the belt is run on roller carriages which are attached at regular intervals.

Moxey, Ltd., of 13, Augustus Road, Birmingham, showed a Moxey-Dillon 5 ft. by 14 ft. fully-floating vibrating screen and a gyratory crusher, the latter being the product of the Babbitless Company (Great Britain), Ltd. A range of belt-conveyor idlers, including both tubular and rubber-disc return types was also included in their display, with a section through a conveyor showing both troughing and return idlers.

North British Rubber Co., Ltd., of Castle Mills, Edinburgh, which is associated with U.S. Rubber Co., showed examples from their range of conveyor belting, hose, and power-transmission belting. Attention was particularly drawn to cotton-nylon and Ustex-nylon belt, extensively used in the U.S.A. and now made here, the greatly increased permissible tension of the second named being specially stressed. Hose shown was that specially designed for use in oilfield drilling and the handling of petroleum products generally.

Nortons-Tividale, Ltd., of Tipton, Staffs., included in their exhibit a 4 ft. by 18 ft. resonant-type classifying screen, of which some more particulars will be available later, it is understood. Mine-car retarders were also demonstrated and other wagon-control equipment.

Priestman Brothers, Ltd., of Hull, were making a feature of the cross-roll slewing ring developed in conjunction with **British Timken, Ltd.,** which was fully described in the MAGAZINE in October last. A number of different types of ore grabs were also shown, including the "Orange-Peel" excavating and dredging grab, the name of which aptly describes its shape.

Ropeways, Ltd., of 62, London Wall, London, E.C. 2, had a working model of a monocable aerial ropeway in operation on their stand. Attention was also drawn to some elements of a new type of conveyor, known as the G-conveyor, of which some advance particulars were made available in a booklet by Glover Brothers (Mossley), Ltd., of Mossley, Manchester. This is of an entirely novel design and it is hoped to give further particulars in a subsequent issue.

Rubber Improvement, Ltd., of Wellingborough, Northants., were showing examples of their range of beltings. Rilflex, which is the newest addition, is a p.v.c. multi-ply anti-static fire-resistant conveyor belting. Tests have shown that a Rilflex belting of only 3 plies is as strong as a cotton belt having double that number. It is lighter and more flexible than even a 4-ply cotton-duck belting and only half the thickness of 6 ply. Troughing characteristics are said to be satisfactory. Leonex and Rilon p.v.c. multi-ply conveyor beltings were also displayed.

Simon Handling Engineers, Ltd., of Cheadle Heath, Stockport, who were showing a continuous bulk-materials handling installation with automatic proportioning, drew attention also to their mechanical and pneumatic plant, such as has been supplied at Kitimat for ship unloading for the Aluminum Co. of Canada, Ltd. The Simon junior sifter for the dust-free sieving of very fine powders was also featured.

Thomas Smith and Sons (Rodley), Ltd., of Leeds, made a special feature of a new truck crane, the M.E. II, which has a separate revolving superstructure and is powered by a 4-cylinder Ford 4D diesel developing 40 b.h.p. at 1,600 r.p.m. The crane carrier is an A.W.D. Ford chassis with either 6 by 6 or 6 by 4 drive, powered by a Ford 6D diesel developing 100 b.h.p. at 2,500 r.p.m., the drive being through a 4-speed gearbox with an independent propeller shaft to each axle.

Richard Sutcliffe, Ltd., of Horbury, Wakefield, drew particular attention to a belt-conveyor installation fitted with an automatic hydraulically-operated loop take-up of new design, which was shown for the first time. This product, which has already been described in the technical Press, has been successfully tried out at Ollerton Colliery, in the East Midlands Division of the N.C.B.

F. E. Weatherill, Ltd., of Welwyn Garden City, Herts., were able to include several new models of their loading shovels in their exhibit. These included a general-purpose shovel with conventional rear-wheel drive and a front-wheel drive machine of otherwise similar type and size and a new version of the "S"-type industrial loader, together with the pedestrian-controlled "Microloda" mechanical shovel.

Wharton Engineers (Elstree), Ltd., of Elstree, Herts., showed three sizes of the W.S. steel conveyor which was described and illustrated in the MAGAZINE in February, 1957, has many applications, and is suitable for gradients of 32° and also for the handling of hot materials.

Hugh Wood and Co., Ltd., of Royal London House, Finsbury Square, London, E.C. 2, were demonstrating the newest design of their signalling and control system as applied to a conveyor which was in operation on their stand. The system is designed for a.c. circuits either bare wire or insulated and can work up to a distance of approximately 3 miles. Another item of interest on this stand was the "Featherbed" idler-impact roller, consisting of a strong coil spring suspended tightly between swivel-mounted ball bearings.

RECENT PATENTS PUBLISHED

☛A copy of the specification of the patents mentioned in this column can be obtained by sending 3s. 6d. to the Patent Office, Southampton Buildings, Chancery Lane, London, W.C. 2, with a note of the number and year of the patent.

24,102 of 1944 (796,589). F. H. SPEDDING, H. A. WILHELM, AND W. H. KELLER. Production of uranium.

27,014 of 1954 (796,409). AUTOMATIC COAL CLEANING CO., LTD. Control of coal-washing apparatus.

29,434 of 1954 (795,727). MAXWORTH METAL PRODUCTS, LTD., AND J. O. EDWARDS. Magnetic separation of ores from gangue.

36,344 of 1954 (796,329). GEWERKSCHAFT EISENHÜTTE WESTFALIA. Gravity pipe for the downward conveyance of coal or other material.

580 of 1955 (796,413). GENERAL ELECTRIC CO., LTD. Electrical prospecting apparatus.

7,335 of 1956 (796,522). APEX CONSTRUCTION, LTD. Vibratory ball-mills.

7,814 of 1956 (797,155). IMPERIAL CHEMICAL INDUSTRIES, LTD. Manufacture of titanium.

10,205 of 1956 (797,158). R. A. BAUM. Flotation apparatus.

11,711 of 1956 (795,790). SOC. D'ELECTRO-CHIMIE, D'ELECTRO-METALLURGIE, ET DES ACIERIES ELECTRIQUE D'UGINE. Recovery of gold.

11,863/4 of 1956 (795,791/2). SOC. D'ELECTRO-CHIMIE, D'ELECTRO-METALLURGIE, ET DES ACIERIES ELECTRIQUES D'UGINE. Treatment of arsenical ores.

12,013 of 1956 (795,793). SOC. D'ELECTRO-CHIMIE, D'ELECTRO-METALLURGIE, ET DES ACIERIES ELECTRIQUES D'UGINE. Treatment of arsenious or sulpho-arsenious ores.

18,410 of 1956 (796,624). RESEARCH CORPORATION. Electrostatic precipitators.

21,024 of 1956 (796,645). HORIZONS INC. Electrolytic recovery of rare-earth elements.

35,535 of 1956 (797,246). ERZBERGBAU SALZGITTER A.-G. Magnetic separator or grader.

2,101 of 1957 (796,275). A. G. MCKEE AND CO. Sealing means for sintering machines.

NEW BOOKS, PAMPHLETS, ETC.

☛Publications referred to under this heading can be obtained through the Technical Bookshop of *The Mining Magazine*, 482, Salisbury House, London, E.C. 2.

Coal Mining Law. By JOHN SINCLAIR. Cloth, octavo, 429 pages. Price 50s. London: Sir Isaac Pitman and Sons, Ltd.

Water in Mines and Mine Pumps. By JOHN SINCLAIR. Cloth, octavo, 130 pages, illustrated. Price 27s. 6d. London: Sir Isaac Pitman and Sons, Ltd.

Progress in Mineral Dressing: Transactions of the International Mineral Dressing Congress, Stockholm, 1957. Sponsored and edited by SVENSKA GRUVFÖRENINGEN and JERNKONTERET. Cloth, large octavo, 754 pages, illustrated. Stockholm: Almquist and Wiksell.

Hartley Gold Belt, Southern Rhodesia: Southern Rhodesia Geological Survey Bulletin No. 44. By J. W. WILES. Part I—Geology, limp cloth, 111 pages, illustrated, with map. Part II—Gold Deposits and Mines, limp cloth, 188 pages, with maps. Salisbury: Government Printers.

Year Book of the American Bureau of Metal Statistics: 37th Annual Issue, 1957. Paper covers, quarto, 136 pages. Price $4·25. New York: American Bureau of Metal Statistics.

Bibliography of North American Geology, 1955: U.S. Geol. Surv. Bulletin 1065. Paper covers, 511 pages. Price $1·50. Washington: Superintendent of Documents.

Ontario Department of Mines: List of Publications (Revised to April, 1958). Bulletin No. 25. Paper covers, 69 pages, with maps. Toronto: Department of Mines.

The Industrial Minerals of Newfoundland: Ind. Min. Div. Mines Branch No. 855. By G. F. CARR. Paper covers, 158 pages, illustrated, with maps. Price $2·00. Ottawa: Department of Mines and Technical Surveys.

Research Council of Alberta: 38th Annual Report, 1957. Paper covers, 56 pages, illustrated. Edmonton: Queen's Printer.

Leeward Islands: The Water Resources of Antigua and Barbuda. By P. H. A. MARTIN-KAYE. Paper covers, quarto, 109 pages, with maps and plates. St. John's, Antigua: Geological Department.

British Borneo: Geological Report, 1957. By F. W. ROE. Cloth, large octavo, 200 pages, illustrated. Kuching, Sarawak: Geological Survey Department.

Salt in California: Calif. Dept. Natural Resources Bulletin 175, 1957. By W. E. VER PLANCK. Cloth board, large quarto, 168 pages, illustrated, with map. Price $3·25. San Francisco: Division of Mines.

Selected Index to Current Literature

This section of the Mining Digest is intended to provide a systematic classification of a wide range of articles appearing in the contemporary technical Press, grouped under heads likely to appeal to the specialist.

* Article in the present issue of the MAGAZINE.

† Article digested in the MAGAZINE.

Economics

***Iron, United States :** *Handling, Ore.* Aiding the Great Lakes Ore Traffic. J. GRINDROD, THE MINING MAGAZINE, July, 1958.

†Mineral, Australia : *Survey*, 1957. Australian Minerals and Metals: 1957 and Current Reviews. J. A. DUNN, *Aust. Min. Ind. Quarterly Rev.*, Vol. 10, No. 4.

Production, Canada : *Ceramics, Survey.* Ceramic Plants in Canada. Canad. Min. Resources Operators List 6.

Production, Canada : *Iron Ore, Ontario.* Iron Ore Mining at Steep Rock. G. E. PEARSE, *Mine, Quarry Engg.*, July, 1958.

†Production, Canada : *Uranium, Bancroft.* The Bicroft Operation. J. D. BRYCE, J. M. THOMPSON, *Western Miner*, Apr., 1958.

Production, Finland : *Copper, Outokumpu.* Mining, Milling, and Smelting Outokumpu Copper Ore, C. MAMEN, *Canad. Min. J.*, May, 1958.

Production, United States : *Salt, California.* Salt in California. W. E. VER PLANCK, *Calif. Div. Mines Bull.* 175, Mar., 1958.

***Research, United States :** *Facilities, Florida.* A New Mineralogical Laboratory in the United States. THE MINING MAGAZINE, July, 1958.

Resources, Canada : *Gas, Survey.* Offshore Exploration for Gas Under the Canadian Waters of the Great Lakes. A. C. NEWTON, *Ont. Geol. Circular* No. 7.

Resources, Canada : *Mineral, Newfoundland.* The Industrial Minerals of Newfoundland. G. F. CARR, Canad. Mines Branch No. 855.

Resources, Canada : *Minerals, Industrial.* The Search for Industrial Minerals in Canada. G. M. HUTT, *Western Miner*, June, 1958.

Resources, Canada : *Potash, Saskatchewan.* The Story of Potash. D. F. HEARN, *Precambrian*, May, 1958.

***Resources, United Kingdom :** *Manganese, Devon.* Manganese in West Devon. R. W. TOLL, THE MINING MAGAZINE, July, 1958.

Geology

Economic, Africa : *Gold, Southern Rhodesia.* The Geology of the Eastern Portion of the Hartley Gold Belt: Gold Deposits and Mines. J. W. WILES, *S. Rhod. Geol. Surv. Bull.* No. 44.

Economic, Asia : *Tungsten, Hong Kong.* Tungsten Mineralization in Hong Kong and the New Territories. S. G. DAVIS, *Econ. Geol.*, June–July, 1958.

Economic, Australia : *Copper, Tasmania.* Geology of the Mt. Lyell Mines. M. L. WADE, M. SOLOMON, *Econ. Geol.*, June–July, 1958.

Economic, Australia : *Gold, Victoria.* Mineralization at the Morning Star Gold Mine, Wood's Point. I. M. THREADGOLD, *Proc. Aust. Inst. Min. Metall.*, Mar., 1958.

Economic, Brazil : *Uranium, Bahia.* Uranium-Bearing Auriferous Reefs at Jacobina, Brazil. J. D. BATEMAN, *Econ. Geol.*, June–July, 1958.

†Economic, Canada : *Uranium, Review.* On the Distribution of Canadian Uranium Occurrences. A. H. LANG, *Canad. Min. Metall. Bull.*, May, 1958.

Economic, United Kingdom : *Lead-Zinc, Mendips.* The Central Mendip Lead-Zinc Orefield. G. W. GREEN, *Geol. Surv. Gt. Britain Bull.* No. 14.

Economic, United Kingdom : *Lead-Zinc, Wales.* Mineral Veins of the Minera–Maeshafn District of North Wales. J. R. EARP, *Geol. Surv. Gt. Britain Bull.* No. 14.

Economic, United Kingdom : *Mineral, Shropshire.* The West Shropshire Mining Region. H. G. DINES, *Geol. Surv. Gt. Britain Bull.* No. 14.

Mineralogy, Determinative : *Uranium, Thorium.* Identification Tables for Uranium and Thorium Minerals. A. VOLBORTH, *Econ. Geol.*, May, 1958.

***Survey, Bore-Hole :** *Indicator, Dip.* A New Electromagnetic Dip Indicator. THE MINING MAGAZINE, July, 1958.

Metallurgy

Iron, Canada : *Reduction, Direct.* Direct Iron Reduction. M. J. UDY, M. C. UDY, *Western Miner*, June, 1958.

Leaching, Bacterial : *Copper, Low-Grade.* How Bacteria Leaches Low-Grade Ores. *Engg. Min. J.*, June, 1958.

Leaching, Pressure : *Manganese, Australia.* Pressure Leaching of a Manganese Ore. R. J. CORNELIUS, J. T. WOODCOCK, *Proc. Aust. Inst. Min. Metall.*, Mar., 1958.

Smelting, Flash : *Concentrates, Copper.* Flash Smelting Copper Concentrates. P. BRYK and others, *Min. Engg.*, June, 1958.

Smelting, Sulphide : *Compacts, Pyritic.* The Oxidation of Powder Compacts of Copper-Iron Sulphides. T. A. HENDERSON, *Bull. Instn. Min. Metall.*, July, 1958.

Machines, Materials

***Asbestos, Blended :** *Uses, Industrial.* Asbestos in a Modern Rôle. W. E. SINCLAIR, THE MINING MAGAZINE, July, 1958.

Carbide, Tungsten : *Uses, Mining.* Tungsten Carbide in Mining. A. F. HOWARD, C. T. GUNDERSON, *Proc. Aust. Inst. Min. Metall.*, Mar., 1958.

***Drill, Alluvial :** *Unit, Mobile.* Aluminium Derrick for Mobile Drill. THE MINING MAGAZINE, July, 1958.

Gear, Haulage : *Materials, Study.* The Metallurgy of Materials for Haulage and Cage-Suspension Gear. R. JEFFREY, B. J. NIELD, *Trans. Instn. Min. Eng.*, July, 1958.

Grab, Sinking : *Design, Russian.* Soviets Mechanize for Fast Sinking While Developing Radical New Methods. G. ROSU, *Min. World* (San Francisco), June, 1958.

Marble, United States : *Properties, Distribution.* Marble. O. BOWLES, *Inform. Circ. U.S. Bur. Min.* 7829.

Motors, Electric : *Drive, Fan.* The Selection of Fan Motors. D. D. STEPHEN, *Coll. Engg.*, July, 1958.

***Ropes, Wire :** *Standards, New.* Steel Wire Ropes. THE MINING MAGAZINE, July, 1958.

Mining

Breaking, Tunnelling : *Rounds, Long.* Drilling and Blasting Long Rounds in Tunnels. J. S. BARKER, *Mine, Quarry Engg.*, July, 1958.

Communication, Underground : *Systems, Review.* Colliery Communication Systems. E. J. KIMMINS, B. L. METCALF, Address, Inst. Min. Eng., July 2, 1958.

Efficiency, Rhodesia : *Plant, Labour.* Improvement in Plant Practice and Labour Utilization at Rhokana. O. B. BENNETT, *J. S. Afr. Inst. Min. Metall.*, May, 1958.

Exploration, United Kingdom : *Coal, Off-Shore.* Off-Shore Boring in the Firth of Forth. *Coll. Engg.*, July, 1958.

Exploration, United States : *Zinc, Tennessee.* How American Zinc's Tennessee DMEA Programme Proved 35,000,000 Tons Ore. C. R. L. ODER, *Min. World* (San Francisco), June, 1958.

General, United Kingdom : *Coal, Shallow.* The Exploitation of Shallow Reserves by Surface Drifts. H. B. BENNETT, *Trans. Instn. Min. Eng.*, July, 1958.

Handling, Transport : *Safety, Colliery.* Safety Aspects of Underground Transport in Coal Mines. A. E. CROOK, Address Inst. Min. Eng., July 2, 1958.

Handling, Tunnel : *Railway, United Kingdom.* Conveyor System for Railway Tunnelling Operations. B. S. PELTON, R. A. STEVENS, *G.E.C. Journal*, Apr., 1958.

Hygiene, Silicosis : *Behaviour, Dust.* The Longitudinal Dispersion of Pulses of Respirable Dust and Gas in Ventilated Mine Workings Studied by a Radioactive Tracer Technique. J. R. HODKINSON, S. J. LEACH, *Trans. Instn. Min. Eng.*, July, 1958.

Hygiene, Ventilation : *Costs, Review.* Ventilation Economics. W. E. COOKE, *Coll. Engg.*, July, 1958.

Open-Pit, Quarrying : *Limestone, Uganda.* Quarrying Limestone for Cement in Uganda. L. R. MABSON, *Mine, Quarry Engg.*, July, 1958.

Open-Pit, United States : *Copper, California.* Open Pit Replaces Underground Mine at Mountain Copper Pyrite Operation. S. H. DAYTON, *Min. World* (San Francisco), June, 1958.

Open-Pit, United States : *Copper, Utah.* How the Bingham Pit Makes a Dropcut. V. S. BARLOW, *Engg. Min. J.*, June, 1958.

Prospects, Evaluation : *Study, Mineral.* Economic Evaluation of an Industrial Mineral Project. J. E. CASTLE, *Min. Engg.*, June, 1958.

Sinking, Shaft : *Coal, United Kingdom.* Shaft Sinking at Wearmouth. *Coll. Engg.*, July, 1958.

Subsidence, Ground : *Study, Mechanics.* Mechanics of Mining Subsidence. H. J. KING, J. T. WHETTON, *Coll. Engg.*, July, 1958.

Support, Ground : *Arches, Yielding.* How Yieldable Steel Sets in Heavy Ground Save Money at Western Mines. G. M. HUCK, *Min. World* (San Francisco), June, 1958.

Ore-Dressing

Drying, Concentrate : *Uranium, Canada.* Drying of Uranium Concentrates. *Canad. Min. J.*, May, 1958.

Flotation, Air : *Study, Bubble.* Effect of Chemical Reagents on the Motion of Single Air Bubbles in Water. D. W. FUERSTENAU, C. H. WAYMAN, *Min. Engg.*, June, 1958.

Flotation, Non-Metallics : *Depressants, Gangue.* Relative Effectiveness of Sodium Silicates of Different Silica-Soda Ratios as Gangue Depressants in Nonmetallic Flotation. C. L. SOLLENBERGER, R. B. GREENWALT, *Min. Engg.*, June, 1958.

†**General, Australia :** *Review, 1957.* Ore-Dressing Developments in Australia. 1957—Part 2. H. H. DUNKIN, *Chem. Engg. Min. Rev.* (Melbourne), Apr. 15, 1958.

Grinding, Autogenous : *Speeds, Super-Critical.* All-Autogenous Grinding at Supercritical Speeds. R. T. HUKKI, *Mine, Quarry Engg.*, July, 1958.

***Handling, Conveyor :** *Systems, Survey.* Selecting the Conveyor Belt. Ore-Dressing Notes, THE MINING MAGAZINE, July, 1958.

Kingdom
Operations
rnal, Apr.,

The Longi-
e Dust and
died by a
ODKINSON,
July, 1958.

Ventilation
July, 1958.

Uganda.
nda. L. R.
3.

California.
Mountain
TON, *Min*.

. How the
. BARLOW,

Economic
ject. J. E.

om. Shaft
y, 1958.

Mechanica
WHETTON

g. How
ave Money
World (San

da. Drying
n. J., May,

of Chemical
Bubbles in
MAN, *Min*

s, Gangue
ilicates of
Depressants
ENBERGER
958.

re-Dressing
2. H. H
Melbourne)

per-Critical
cal Speeds
1958.

. Selecting
Notes, THE